ELECTRICAL REVIEW

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ELECTRICAL REVIEW

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24 AUGUST 1956

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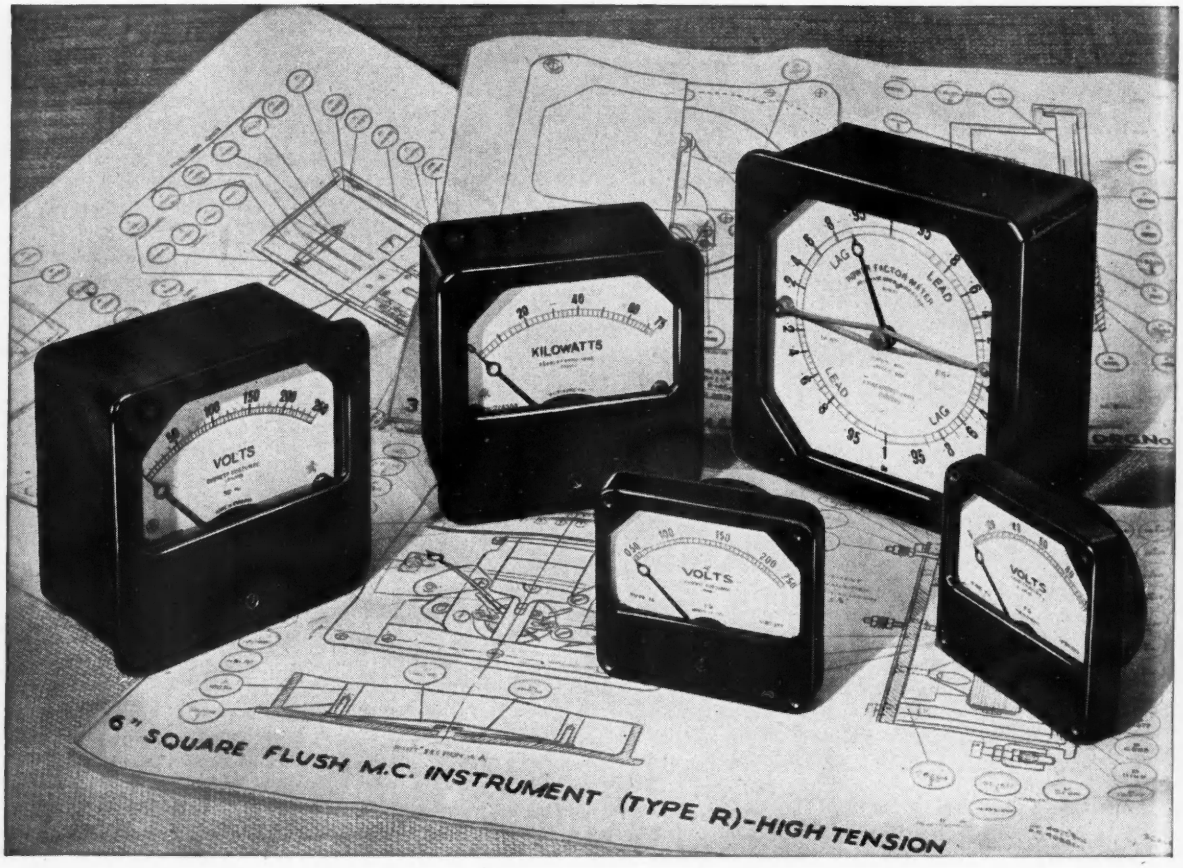

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ELECTRICAL REVIEW

24 August 1956 Vol. 159 No. 8 Established 1872

Power Reactor Developments

WHEN the 92 MW Calder Hall nuclear generating station in Cumberland is officially opened by H.M. the Queen in October the age of nuclear power will be upon us and for the first time anywhere in the world a nuclear power station will be in full commercial operation feeding electrical power into a national network. Although British engineers and scientists are to be congratulated upon their achievement, work in this field has only just begun and if we are to maintain our lead over other nations maximum effort must be exerted for many years to come; capital must be invested in large-scale experiments, experience gained by the maximum number of men in the operation of nuclear power plants, and, perhaps more important still, an increasing number of suitably qualified men must be made available by our universities and technical colleges. In other words, it is up to all of us to see to it that the enormous advantages to our national economy which can eventually accrue through the widespread development and application of nuclear power are not allowed to, so to speak, slip through our fingers.

As most of our readers will know, there are two reactors of the graphite-moderated gas-cooled type at Calder Hall and each is associated with two heat exchangers each of which, in turn, supplies steam at 200 lb/sq in and 590 deg F and 53 lb/sq in and 340 deg F to a 23 MW turbo-alternator set. These reactors have been designed primarily for the production of plutonium and are very similar to older piles in use for this purpose at Windscale, where all the heat generated is wasted. At Calder Hall, however, this " waste " heat is utilised in heat exchangers to raise steam and produce electricity as a by-product. The design has been arranged to achieve the maximum production of plutonium together with the maximum generation of electricity irrespective of the overall station thermal efficiency.

In the light of experience gained so far in the design and construction of Calder Hall it is now considered a comparatively simple matter to design a basically similar reactor to have maximum thermal efficiency together with the maximum production of electrical power, taking whatever plutonium is produced as a " free gift " in the form of a saleable by-product. Serious work on piles of this type has been under way for some while now and they will be installed in successively improved versions in the nuclear power stations to be constructed during the next ten years by the Central Electricity Authority.

ATOMIC ADVANCE

Next month the four groups, headed by the leading electrical engineering concerns of the country, which were asked to prepare schemes for the first atomic power stations of the C.E.A. have to present their tenders to the Authority. The preparation of the schemes has involved a great deal of costly exploration into the new factors introduced by nuclear fission into power station work. Mr. A. Lindley, who is in control of the G.E.C. Simon-Carves Atomic Energy Group at Erith (the subject of an article in this issue), pointed out last week that to achieve so much in so little time was costing his company a great deal of money, for no aid was forthcoming from Government or other sources. Of course those who are preparing the schemes have had the advantage of the fundamental research of the Atomic Energy Authority, but new conditions are now encountered, much of them being in the field of heavy mechanical engineering and involving metallurgical and heat-transfer problems.

Mr. Lindley was not able to reveal the capacity of the projected atomic power station but it will be considerably larger than that at Calder Hall. It was thought that firm overseas orders for this type of plant would not materialise until the first British stations had proved themselves in operation for about three years. Mr. Lindley said, however, that this country would then be in a favourable position to meet such orders.

ENGINEERING WAGES

A month or two ago the Engineering Employers' Federation forestalled a demand for further wage increases in their industry by announcing that the trend in overseas markets precluded any substantial addition to production costs and prices. In spite of this the Confederation of Shipbuilding and Engineering Unions last week decided to seek meetings with the employers for the presentation of a claim for a "substantial increase" in wages. In moving the resolution Mr. R. Openshaw, president of the Amalgamated Engineering Union, asked how, if the recession in car manufacture spread elsewhere, the unions could check their members' demands. But how can recession and higher wages be squared? Several delegates, including the president of the Electrical Trades Union, anticipated the employers' refusal to accede to the demand by threatening to fight to secure the increase. Much was said about the industry's profits but recently there has been a drooping tendency which would be accelerated by greatly increased labour costs.

EQUIPMENT FOR RUSSIA

During their recent visit to this country Messrs. Bulganin and Khruschev gave some particulars of the equipment which the Soviet Union was prepared to purchase in the United Kingdom. As the result of a later visit by Mr. Malyshev the *Board of Trade Journal* is able to publish a complete list of this equipment and has classified it under the headings "Non-embargoed Goods" and "Embargoed Goods"; some items in the first list are subject to quantitative restrictions. It is interesting to note some of the distinctions which are made in an endeavour to prevent anything in the nature of war material going to Russia. For instance while vacuum electric furnaces for non-ferrous metals are not subject to the ban, similar types of furnaces for steel melting are, although the non-embargoed list includes "electric steel smelting furnaces for 70-200 tons with magnetic stirring."

This list also includes "automatic equipment for the production of electric lamps and mechanised production lines for luminescent, lighting, bispiral, gas-filled electric lamps and car lamps." But "mechanised production lines for miniature and sub-miniature valves" are banned, as are equipment for the production of semi-conductors and resistors, drawing machines for molybdenum and tungsten wire and some allied equipment. There is no mention of small generators in the non-embargoed list but the embargoed list includes an item "Complete turbo-generating plant (boiler-turbine-generator-transformer) with a capacity of 325,000 kW working with steam under pressure of 350 atm. and temperature of 650°C with all auxiliary equipment and complete automatic control devices." A supplementary list of automation equipment requirements is also published with a note that the position under security controls has not yet been determined.

CELLULAR POLYTHENE

In this issue Mr. J. Moss draws attention to the development of a new dielectric material for use in cable construction. Cellular polythene consists of polythene with a system of non-connected gas cells distributed throughout it. The principal feature of the new material appears to relate to economics, in that, in spite of its lower electrical and allied characteristics, it is a suitable alternative to polythene for certain applications. For instance, the author points to television downleads as an obvious application of cellular polythene as a dielectric since the material possesses all the advantages associated with semi-air-spaced cables of conventional types while the closed cells give improved resistance to water ingress. The dielectric strength of the material, although only about one-third of that of polythene, is 150-250 V/mil, which is more than adequate for downlead purposes.

As the author stresses, much work remains to be done, for instance, in the refining techniques of extrusion and obtaining blowing agents which will decompose to give finer gas cells while leaving no residue; but the challenge is obvious.

COSTS AND PRICES

The *Board of Trade Journal* notes a slight reduction in the prices of basic materials used in manufacturing industry during the first half of this year—the index fell from 155·3 in December last (June, 1949 = 100) to 155·2 at the end of June. There was a significant decrease in the cost of materials used in the electrical machinery industry, the index for which fell from 195·8 to 184·2. It should be said, however, that this figure is substantially higher than those applying to other groups in the Board of Trade's classification. The reduction is attributed mainly to the fall in the price of copper of about 22 per cent. In spite of lower material costs the generality of prices of manufactured products have continued to rise, the reason being a $6\frac{1}{2}$ per cent rise in weekly wage rates.

Experience with S.C.A. Conductors

Methods of Securing the Best Results

By N. G. SIMPSON, M.I.C.E., M.I.E.E., A.C.G.I.*

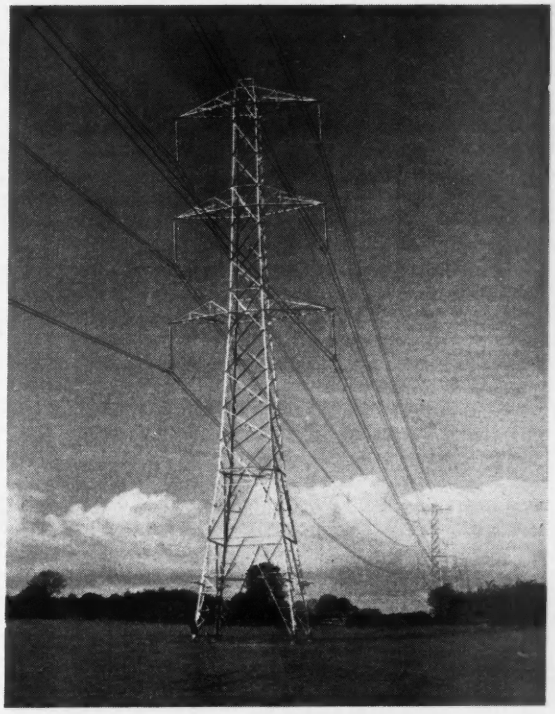
UNTIL the late 'twenties, conductors for both transmission and distribution overhead lines in the United Kingdom were invariably of hard drawn copper. System voltages seldom exceeded 33 kV and the most appropriate and economic structural form of overhead lines consisted of comparatively short span wood pole supports and pin type insulators. The high conductivity, robustness and simple character of fittings, almost complete immunity from contamination, and low cost of hard drawn copper practically ruled out other conducting materials.

The passing of the Electricity Act of 1926, the subsequent construction of the British grid and the expansion of urban and rural electrification which followed in the early 'thirties called for something more in the way of conductor structural requirements than hitherto. On the one hand the adoption of a grid voltage of 132 kV justified the general use of long spans, lattice steel tower supports, suspension insulators and steel-cored aluminium conductors. At the same time the development of less populated rural areas with comparatively lightly loaded 11 and 33 kV lines led to the use of cheap but efficient construction with small-size conductors of high tensile strength and other materials, since the sags of small hard drawn copper conductors with the prevailing British regulation ice and wind loadings were excessive and imposed an undue limitation on span lengths.

Alternatives to Copper

The adoption of standard h.v. wood pole construction in recent years under B.S. 1320 with its relaxed mechanical loadings has gone a long way to offset this trend apart from the aspects of high copper conductor costs. However, in the early years in both the high and lower voltage range of transmission lines alternative conductor material and forms were introduced and basic hard drawn copper, despite its cheapness and indisputable advantages, began to encounter serious competition. Cadmium copper alloy conductors with greatly increased tensile strength but slightly lower conductivity came into more frequent use as well as composite copper conductors such as copper-cored steel, steel-cored copper and copper-covered steel wire. With the exception of cadmium copper, and copper-covered steel wire in some overseas territories, none of the others has retained any permanence in general use due principally to corrosion problems arising from the combination of steel and copper strands.

Up to the war, and apart from their general adoption on the British grid some years before, it may be claimed, s.c.a. conductors played an increasingly progressive part in the general electrification of this country, as elsewhere. Copper retained its almost exclusive use on low-voltage distribution but lost ground on high- and extra-high-voltage systems. This situation was influenced naturally by both technical merits and demerits as well as by a close price differential between the two basic materials, copper and aluminium. Although the latter was approximately twice as expensive weight for weight as copper, the lightness of aluminium offset this disadvantage since for equal conductivity the weight of aluminium is half that of copper.



Straight line double circuit tower as constructed in the supergrid. The conductors are twin 0·4 sq in copper equivalent s.c.a.

Since the war this somewhat delicate balance between the spheres of use of the two materials has been largely upset by the phenomenal rise in the price of copper to the extent that now the cost by weight of aluminium is approximately half that of copper, a reversal of pre-war conditions. Aluminium, steel-cored aluminium and aluminium alloy conductors are consequently in greater demand over the whole range of overhead lines. This price handicap of copper has existed now for some years and shows no signs of a reversion towards pre-war conditions. Moreover, the opening up and large exploitation of new sources of raw materials to manufacture aluminium cheaply would appear to justify an assumption that adequate supplies of aluminium will continue to be available at a favourable price.

The present outlook may therefore assume a progressively greater use of aluminium, aluminium alloy and s.c.a. conductors for overhead lines in every part of the world. Transmission system voltages are increasing towards 500 kV and s.c.a. conductors especially are likely to hold their own in this field.

There are now something like 30,000 miles of s.c.a. conductor in operation in the United Kingdom, mostly in the higher system voltages and installed during the last 25 years. The range of sizes has not been limited since 7/·093in (0·025 sq in equivalent copper) is common enough and more recently the British supergrid has adopted 61/·125in (0·4 sq in equivalent copper) as a standard.

Aluminium does not compare favourably with copper in

* Transmission Consultant, British Insulated Callender's Construction Co., Ltd.

either conductivity or tensile strength, these being approximately 60 per cent and 40 per cent respectively. The deficiency in strength in conductors, however, can be more than made up by the addition of high tensile galvanised steel strands to form a composite s.c.a. conductor. Alternatively, aluminium can be replaced entirely by a higher strength aluminium alloy, omitting the steel core. The composite conductor form introduced, at the outset, potential design complications and operational hazards since the physical characteristics of aluminium and steel are so different.

The modulus of elasticity of steel is about three times that of aluminium and the coefficient of expansion nearly half that of hard drawn aluminium. These characteristics influence the behaviour of the conductor under tension. The virtual modulus and coefficient for a composite conductor are calculated so that the disposal of stress gives the same extension in aluminium and steel, and from the temperature coefficients there can be no relative movement between the two materials under tension.

B.S. 215 covering hard drawn aluminium and s.c.a. conductors was first published in 1925 and there have been subsequent revisions. Briefly, sizes are available, related to their equivalent copper areas, from 0·01 to 0·5 sq in using single-strand galvanised steel for smaller sizes and seven-strand galvanised steel cores for the larger range of sizes. The tensile strength of these cores ranges from 80-90 tons/sq in and they contribute from 50-70 per cent of the overall conductor strength. The aluminium and steel sizes are such that the overall tensile strength of standard s.c.a. conductors ranges from 35 to 70 per cent more than that of comparable hard drawn copper conductors of equal conductivity.

Manufacture and Handling

No review of s.c.a. practice would be complete without a brief reference to manufacturing aspects. Aluminium employed for the manufacture of conductors is of a special grade, "EC," or "electrical grade" containing not less than 99·5 per cent aluminium and complying with B.S. 2627:1955, "Wrought aluminium for electrical purposes: wire"; and B.S. 215:1934, "Hard drawn aluminium and steel-cored aluminium conductors."

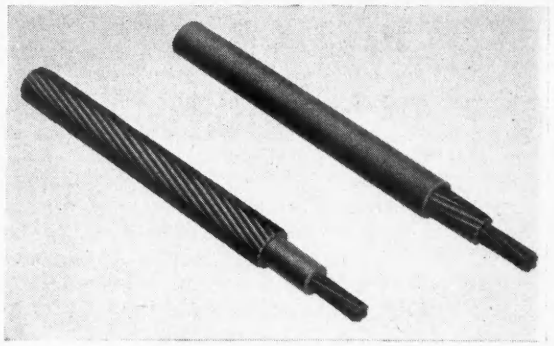
The conductivity of aluminium is greatly affected by certain impurities, and it is worthy of note that B.S. 2627, the most recent specification, calls for the resistivity of hard wire to be not more than 2·8264 microhm-centimetres at 20 deg C (corresponding to 61 per cent conductivity by the I.E.C. standard for copper). Certain overseas countries specify other values and it is hoped there will be a trend towards conformity with the above figures, recommended for adoption by the International Convention held in Philadelphia a short time ago.

Most of the wire is drawn hard from the $\frac{3}{8}$in rod size to the finished size, without intermediate annealing, and usually with one, but possibly with two drawing machine operations. The cold working effect thus differs according to the diameter of the wires; this is recognised in the different tensile strength figures quoted in specifications.

In conductor stranding the jointing of wires is avoided as far as possible. Where necessary the normal jointing method is by resistance welding, although the recently developed cold pressure butt welding shows considerable promise.

Contamination of wire with deleterious foreign matter must be avoided during processing and in subsequent storage.

It is fundamental that aluminium conductors must be handled with greater care than those of other materials. In the running out of conductors prior to tensioning special care should be exercised to avoid contact with rough ground and obstructions likely to lead to abrasions.



Extruded sheath steel cored aluminium conductors, one with an external and the other with an internal sheath

Radio interference from power lines has lately become a critical problem. In the lower voltage ranges it is usually caused by local sparking and leakage currents at points of support and from line fittings. At transmission voltages of 220 kV and upwards interference may be caused also by local corona on the conductors themselves. It is now becoming apparent that conductors of any material should be as free as possible of even slight abrasions as well as foreign matter taken up during erection, to avoid corona losses and radio interference.

There is now a pronounced tendency for e.h.v. conductors to be erected without contact with the ground. Instead of running out conductors from drums along the ground and hoisting them at supports, steel pilot wires are run out through sheave blocks throughout a section, followed by the conductors either under moderate tension or sometimes at tensions approximating to their erection conditions. This means some elaboration in construction gear to control the drum movements synchronously with the pulling out arrangements at the other end. During the operation of tensioning conductors to correct sag, and prior to transference to insulator clamps they are run through and supported by sheave blocks. With s.c.a. conductors close attention is necessary to the design and manufacture of these blocks to ensure, especially with the larger sizes of conductor, that groove size and shape are matched to the conductor to prevent its distortion during sagging. The sheave block diameter must also be large enough to prevent undue bending stresses, especially when the conductors are run out under tension and if there are large changes of direction at the sheaves. British and American practice favours sheaves about 10-12 times the conductor diameter. Continental practice tends to be more conservative to the extent of using sheave blocks 15 or even 30 times the conductor diameter.

In some cases two or even three smaller size sheave blocks have been used in tandem in one unit to distribute the pressure on large conductors and reduce bending radii. Roller bearings for important jobs are essential to reduce friction to a minimum. These somewhat elaborate trends are confined mostly to long span e.h.v. lines which, because of their high electrical load capacity, usually employ large conductors with multi-layer aluminium strands, and overall, large tensions. A typical example is that (of which there are two per phase) of the British supergrid, a 0·4 sq in copper equivalent with 54 strands of aluminium and seven strands of steel, each of 0·125in diameter. The overall diameter is 1·125in and the breaking strength just over 30,000 lb.

All new conductors are liable to a certain amount of

settlement subsequent to erection. With homogeneous conductors the allowance to be made for this by overtensioning is straightforward. With large composite s.c.a. conductors the amount of overtension to be used is appreciable and to some extent more problematical, due mainly to a substantial amount of inelastic stretch of the aluminium components. In other words the elastic modulus of the aluminium, and thus of the whole conductor, is different initially from that after a series of mechanical loading cycles. It has been found that if such conductors can be tensioned at the outset to something like their full design loading for a short time, say, half an hour, the greater proportion of the inelastic stretch can be removed and the conductor then strung closely to correct sag based on its calculated values of elastic modulus. For large conductors this involves additional expense in erection gear with greater precautions to be taken to prevent damage to supports.

In the United Kingdom it is usual to adopt the principle of overtensioning to a calculated percentage, allowing time and natural loading cycles to take out the inelastic stretch. American practice favours the use of separate charts for erection and final sags and tensions based on experimental values of the elastic modulus before and after a full load cycle. When stringing e.h.v. lines using twin conductors the required tolerance in the ultimate sags between each of the twins is small. This has recently called for refinements in the practice of conductor stringing, not only during erection and subsequent settling period, but in ultimate service. It is usual in any case to include in the tension insulator strings some form of sag adjustment for use after the line is strung and clamped in.

With these twin conductors, spacers are required to prevent clashing in mid-span. The full mechanical requirements of spacer design have yet to be established as sufficient long-term experience is not available. They have to perform an arduous and continuous mechanical duty, to have a certain flexibility of movement whilst retaining a secure but harmless grip on the conductors and fulfilling overall their primary function as spacers. British practice, with its horizontally placed twin conductors, has limited this flexibility to a small horizontal twist between each conductor clamp and the two spacer ends. Experiments with other forms are, however, in progress.

Service Experience

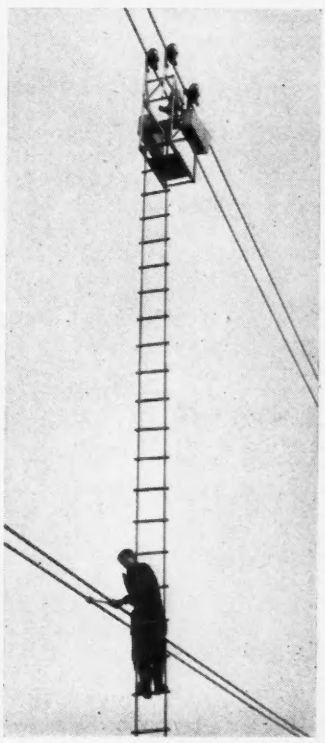
The trend of statutory regulations in recent years has been towards a relaxation of conductor ice and wind loadings, which in turn leads to tighter sags. This alongside the greater use of s.c.a. conductors with their high strength to weight ratio and application to long span e.h.v. lines has associated them with vibrational problems. The development of large electrification schemes in many overseas countries, where there is an absence of ice loads, leads to high everyday tensions, with a consequent aggravation of vibrational effects. It is correct to say that s.c.a. or for that matter any high tensile conductor in the larger sizes can seldom be tensioned to the fullest extent permitted by the strict application of statutory loading regulations.

A supplementary condition is usually incorporated into specifications or adopted in design practice, of limiting the conductor stress at everyday temperatures (the conditions which prevail for something like 95 per cent of its life). This limit is not subject to a precise technique and depends on experience or individual opinions as well as on the use or otherwise of vibration dampers. It is, however, unusual to utilise everyday tensions greater than 20 to 25 per cent of ultimate strength and this with the use of vibration dampers. American practice tends if anything to be more conservative, with some justification on the issue, not so much of damage to the conductor in mid span, but secondary effects on the conductors by support fittings. Most, if not all, of such damage is due to this cause.

It is likely that with improvements in our knowledge of fittings design, conductor everyday tensions could with advantage be increased. Apart from this there is still a lack of precise knowledge of the real effectiveness of vibration dampers. We know they operate satisfactorily but there has seldom been an opportunity of proving that they can dampen vibration at higher tensions than those normally employed. It has been said that there is no point, and no economy in many cases, for increasing tensions because intermediate support savings are offset by the increased cost of angle and terminals. Nevertheless, we need to know more of the possibilities of erecting s.c.a. and other conductors at tensions higher than at present, with and without vibration dampers, and without suffering damage, all alongside an improvement in our fittings technique. Such knowledge is likely to be found more from practical experience than from involved theory. Unfortunately, it is difficult to collate and analyse the large fund of international experience. A specialist panel of C.I.G.R.E. Study Committee No. 6 is engaged on such a study at the present time from which some valuable conclusions may be expected.

When reviewing experience with s.c.a. or other composite conductors, the question of corrosion must inevitably be dealt with. It is necessary to avoid generalisations because many thousands of miles of s.c.a. conductors of all sizes and types have been in successful operation for 20 and 30 years in many parts of the world, a large proportion of them without the protective treatment normally applied to-day.

In the early days there were cases of corrosion due to lack of purity in the production of aluminium, and to foreign impurities imposed on the aluminium strands during manufacture. Nowadays, both of these sources of trouble may be discounted. The forms of corrosion which have received most attention and investigation in recent years are those of "internal" and "external" corrosion. This subject is fully dealt with in Forrest and Ward's I.E.E. paper (Vol. 101, Part II, No. 81, June, 1954) but briefly the former concerns the reactions which take place between the inner aluminium layers and the zinc galvanising of the steel core due to the presence of moisture, usually saline, within the strands. The symptom is a characteristic bulging of the conductors, due to the formation of hydrated aluminium oxide. It is important to



Fitting twin conductor spacers on the Staythorpe-Elstree 275 kV line

remember that in the majority of cases the aluminium is sacrificed leaving the steel core intact.

External corrosion is usually confined to industrial districts where there may be direct chemical corrosion of the outer layers from the combined effects of sulphur oxide moisture and the insoluble parts of solid pollution from industrial chimneys. In their comprehensive analysis of British grid experience Forrest and Ward estimate the average life of s.c.a. conductor to be from 25 to 30 years, although extreme cases may range from 3 to 50 years. In the interests of perspective it must be noted that the experience is related to a comparatively small country with a large coastal area and as heavily industrialised as any in the world.

Overseas Experience

S.c.a. conductors have been used in other countries to a greater or less extent and for an equally long time. In France experience dates back to 1919 and it is right to say that a large proportion of the conductors erected since that date are still in service. Failures were largely confined to coastal areas, although curiously enough there was less trouble in the Mediterranean region than along the Atlantic seaboards. As far away as New Zealand experience is available from 1923 and here again few corrosion troubles have been encountered even in cases within a few miles of the sea. In South Africa and Rhodesia the use of s.c.a. has naturally been restricted in general use but some 20 to 25 years' experience is available to show a satisfactory record of behaviour. For example, samples of seven-strand s.c.a. erected in 1914 near Cape Town were tested in 1952 and showed tensile strengths exceeding values originally specified.

Interim results are available of an experimental installation in the Mombasa area of East Africa where seven-strand s.c.a. conductors were erected for exposure tests in what might be regarded as the worst combination of marine influence and severe tropical humidity to be found in the world. The first conductors were erected in early 1947 and untreated conductors were heavily corroded after four years. Bitumen treatment of cores failed to give reasonable protection, as after two years the bitumen had dried to such an extent as to expose large portions of the galvanised steel protection. Results with grease and oil treatment have been greatly superior and examinations after four years showed that the galvanised coating was still intact and the additional protection still effective.

The previous reference to United Kingdom experience concerns principally the large s.c.a. conductors used on the British grid. The smaller sizes as normally used for distribution have for the most part been proved to give long service. Again there has been evidence, but not consistent evidence, of corrosion in coastal areas. The majority of cases have been of untreated or bitumen-treated conductors. Even with such conductors a limited life in coastal areas is by no means a foregone conclusion. A large mileage of 0·075 and a small amount of 0·03 sq in s.c.a. conductor were erected in the extensive 33 kV distribution system of the Electricity Board for Northern Ireland in the early 'thirties, a fair proportion in the coastal area. Experience has shown no corrosion trouble out in the span, but a good deal of corrosion with fittings, connectors and joints, which in the early days were made "dry." Substantial improvement has been made since all fittings were greased around 1936.

Experience in the Isle of Man on a similar 33 kV system with 0·03 segmental s.c.a. has not been so fortunate. Conductors erected in 1939 are showing fairly extensive corrosion and here again the lack of additional treatment may have had a large bearing on behaviour.

Perhaps one of the most recent and interesting developments is the extruded aluminium sheath conductor where the outer or inner layer of aluminium is replaced by a homogeneous extruded sheath, the principal object of which is to seal off completely the steel core and thus prevent any possibility of internal corrosion. A section of 132 kV line near Hale in Cornwall has recently been strung with conductors of this type to serve as an operational field test.

Conductor fittings for use with s.c.a., as those for other conductors, have in the past exhibited weaknesses from vibration, corrosion, overheating or general mechanical deficiencies, sometimes long before the conductors themselves have deteriorated. There is now a general trend towards the use of compression techniques for current-carrying fittings wherever possible. This extends downwards to the lower range of sizes where MacIntyre twisted sleeves or cone joints have normally been used. Connectors of the parallel groove type are particularly vulnerable under adverse climatic conditions and their design and installation must still be the subject of close control, including the liberal addition of protective grease within the joints. The material particularly must be of correct composition and purity.

On the broad aspect of corrosion it is appropriate to mention that where doubt exists as to the suitability of s.c.a. for a particular situation the alternative use of aluminium alloy conductor will doubtless arise, since its physical characteristics are comparable to s.c.a. and it has the basic advantages of a homogeneous conductor. Whilst the effects of galvanic corrosion are absent it has, however, no superior properties as regards chemical corrosion to those of aluminium as used in composite conductors.

In making a decision as between these two types the effectiveness of present protective measures applied to s.c.a. should not be overlooked. Altogether, comparison should tend now to rest rather less on corrosion aspects and to include in its scope such matters as mechanical performance, where it may be claimed, for example, that s.c.a. has some superiority as regards vibration effects, and in any case some reserve of strength in the event of damage to outer strands, by reason of its steel core the strength of which is seldom seriously impaired.

Summarising this survey of s.c.a. experience it may be said firstly that as a composite conductor it has basically or potentially some of the disadvantages of all composite conductor forms. On the other hand it possesses the substantial advantage of high tensile strength and adaptability in design to cover the whole range of transmission and distribution requirements including special cases such as high and long span crossings.

A vast mileage of s.c.a. conductor has by now been installed all over the world, most of it having had a long and satisfactory life, and the record of faults by comparison is extremely small. Deficiencies in operation have been overcome, particularly in the matter of corrosion and a comparatively low price level compared with other materials has been maintained.

Steel Films in Bessemer Tribute

A special programme of steel films is being screened in Sheffield's Central Library on 5th September as a tribute to the memory of Sir Henry Bessemer, inventor of the Bessemer steel making process. It was at the British Association meeting in Cheltenham 100 years ago that Bessemer gave the first details of his revolutionary invention and to commemorate the centenary at this year's meeting the six films selected all deal with aspects of the steel industry including, of course, the Bessemer converter.

Nuclear Power Development

The Work of the G.E.C. Simon-Carves Atomic Energy Group

ABOUT two years ago the four leading British electrical manufacturing groups were asked to study the gas-cooled graphite-moderator reactor which was being adopted for the first British nuclear power stations. At the same time it was suggested that each group should take into partnership for this work one of the leading boiler makers and as a result the General Electric Co., Ltd., made an arrangement with Simon-Carves, Ltd., and an Atomic Energy Group was formed.

Because the bulk of the work involved in the provision of nuclear power stations is heavy mechanical engineering it was thought appropriate to centre the Group at the Fraser & Chalmers Works at Erith where the G.E.C.'s heavy mechanical plant is produced. Last week we were able to visit the new establishment and see some of the design and development work in progress. Mr. A. Lindley, a director of the G.E.C. and general manager of the Fraser & Chalmers Works, is in control of the Group.

At present the laboratories, engineering design and drawing offices have an area of 33,000 sq ft and large extensions are contemplated. There is a staff of over 200 of whom about half are university graduates. Three-quarters are G.E.C. people and the remainder are from Simon-Carves.

The work of the laboratories is classified broadly under materials research and heat transfer research. There is also an electronic analogue computer capable of simulating the performance of a complete nuclear power station under various conditions. Thus, the establishment comprehends all facilities for research, design and testing in the development of commercially-built nuclear power stations.

Materials Research

Our attention was first called to the very well laid out and lighted drawing office and then we saw something of the materials research. It was explained that three special factors enter into the choice of materials for service within a reactor. First, many commonly-used materials are excluded because of their high neutron absorption cross-sections. Secondly, there are many components which cannot be inspected, maintained or replaced once the reactor is in operation. Thirdly, most organic materials are damaged by irradiation to an extent which precludes their use. The problem is thus to find materials possessing the desired strength at high temperatures and pressures which can be economically fabricated in the required quantities. This is the principal function of the two materials research laboratories.

Small amounts of carbon monoxide are produced by the interaction of the CO_2 coolant gas and the graphite moderator, and water vapour is also present. Much experimental work has been devoted to the determination of the resistance to oxidation and corrosion of materials used in the reactor circuit, particularly the magnesium alloys used for the fuel element cans and the steels employed in the construction of reactor pressure vessels, heat-exchanger shells, gas ducting and other components.

A special thermobalance has been designed for the rapid measurement of the rates of oxidation of magnesium in carbon dioxide. This is an electrically-heated pressure vessel in which the specimen under test is supported by a spiral quartz spring. As oxidation of the heated specimen in a carbon dioxide atmosphere under pressure takes place weight changes are reflected in the vertical movement of the quartz spiral. The movement is continually observed through a window by a travelling microscope. By using a number of these vessels simultaneously, operating at different pressures or temperatures, graphs of oxidation with time can be quickly obtained. Other metals than magnesium can be tested in this apparatus.

The pressure vessels of the reactor and the heat-exchanger shells, which will be fabricated on site by welding, call for a careful selection of steels. They must be resistant to creep at the operating temperature, resistant to failure by brittle fracture, and weldable. Each reactor pressure shell will weigh several hundred tons and will be subjected to a combination of pressure and temperature never before attained in a vessel of this size. (The vessels are to be fabricated by the Motherwell Bridge & Engineering Co. and the civil contractors will be John Mowlem & Co., in association with the G.E.C. Simon-Carves Group.)

A battery of twenty-three G.E.C. vertical heat treatment furnaces has been installed for corrosion tests on steels and other alloys. Specimens are placed in a pressure-tight stainless steel autoclave on each furnace and tests have been carried out in various carbon dioxide/carbon monoxide mixtures, with and without additions of water vapour and over a range of gas pressures.

The cooling fins on the fuel element cans are subjected to bending stresses caused by the high-pressure coolant gas flowing over them. The fins may therefore creep during operation, and a test rig has been devised to examine this effect.

A battery of stress corrosion machines is being installed so that the corrosion resistance of metals and alloys under

General view of one of the materials research laboratories

load can be measured. Work initially will again be on magnesium in carbon dioxide atmospheres, but the equipment can readily be converted to deal with other materials and other corrosive media.

A G.E.C. 25 kW high-frequency furnace can be used for the induction melting of small amounts of experimental metals and alloys, including those with very high melting points, and for work on powder metallurgy and brazing.

The development of welding techniques for magnesium alloys and other materials such as stainless steel is an important part of the design programme. A 300 A argon arc welding set installed in one of the metallurgical laboratories can be operated with either manual or automatic control.

Heat Transfer Investigations

The amount of heat which can be extracted from a fuel can is one of the controlling factors in reactor design, and the investigation of heat transfer characteristics is an important part of the experimental work undertaken at Erith.

In the main heat transfer apparatus the measurement of heat transfer coefficients and friction factors is carried out under conditions of temperature and pressure resembling those in a reactor. The fissile fuel is replaced by a stainless steel heating element inside the fuel can, the heater power being supplied by two d.c. generators. The can is supported within a copper tube, lagged to prevent heat losses. Carbon dioxide is circulated under pressure throughout the system by a steam turbine driven blower; provision is made for supplying the gas with extra heat and also for making up the small losses of gas occurring during circulation. Measurements are made of gas and fuel-can temperatures and of gas flows and pressure drops so that a heat balance can be obtained.

There is also a heat transfer rig in which experiments are carried out in air at atmospheric pressure instead of under pressurised carbon dioxide. This equipment is basically similar to the CO_2 rig but is very much simpler and quicker to operate. Air is drawn over the cans by a blower driven by a constant speed motor through a fluid drive. The apparatus provides valuable data on the maximum heat output obtainable from a given design of fuel can at a particular temperature.

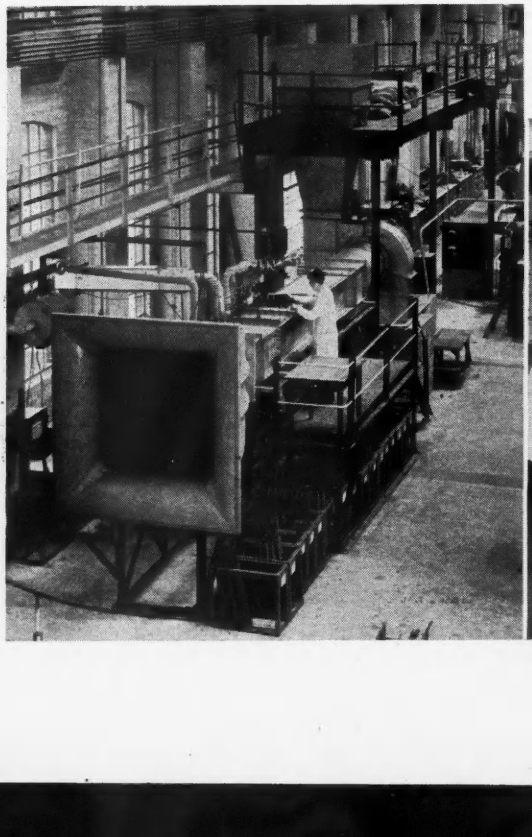
Another matter under study is the heat transfer within the can itself, i.e. from the centre of the uranium fuel rod, where the heat is generated, to the outside of the fuel, and also from the surface of the fuel to the walls of the can. The effect of surface roughness on the inside of the can and of oxide films on the uranium are among the factors influencing the effectiveness of heat transfer.

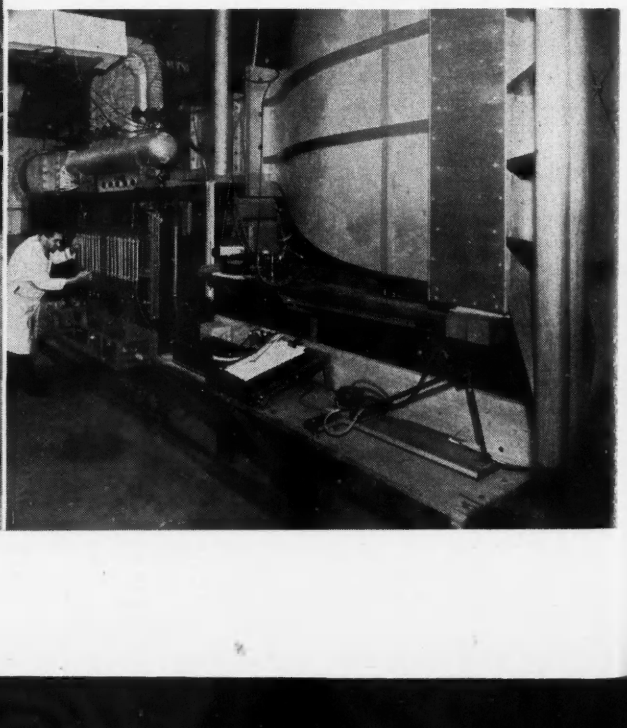
These and other problems are all receiving intensive study from the point of view of the present design, and, no less important, with an eye to future reactors of improved performance.

On leaving the reactor, the hot gas is led away to heat exchangers for steam raising. Because of the relatively low temperature difference compared with fuel-fired plant of the same output, it is necessary to devise a compact arrangement of heat exchange surface in order to keep to the minimum the size of the pressurised vessel required.

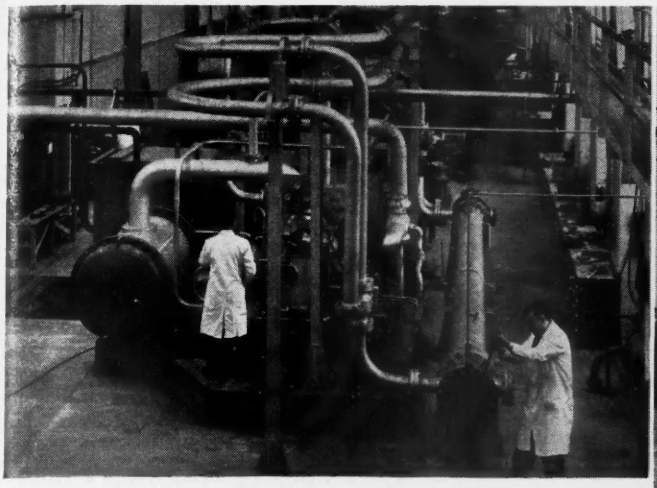
To achieve this large numbers of small diameter steel tubes with an extended surface in the form of fins are used. The combined heat exchangers for one nuclear power station might contain up to 300 miles of tubing. The use of extended surfaces in such large plant and under such conditions is unusual and has entailed a major development programme on the metallurgical and manufacturing aspects as well as an investigation into heat transfer and pressure drop.

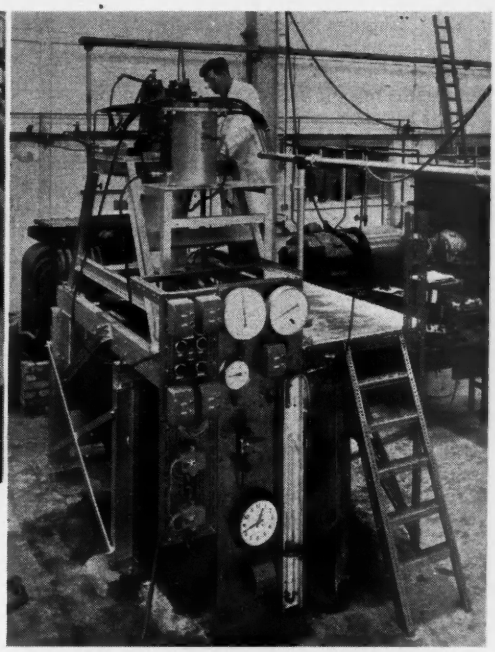
Equipment constructed for the experimental work is illustrated. In practice, the hot gas will pass downwards through the heat exchangers over the banks of tubing through which water and steam are flowing. Heat transfer is therefore inwards through the heat exchanger tubes to the water. In the experimental apparatus this procedure is reversed: dry superheated steam is passed through the heat exchanger tubes and heat is extracted from them by a current of cooling air. An assessment of the effectiveness of a particular design of tube is then easily obtained by measuring the amount of steam condensed in a given time. This method has proved extremely successful in practice and has permitted the rapid testing of numerous alternative





Left: Equipment for the measurement of heat transfer characteristics of heat exchanger tubes and (below) experiments being carried out on samples of the tubes





Above: Pressurised carbon dioxide rig for experiments on the heat transfer properties of fuel cans and (right) a gas seal under development in the heat laboratory

designs of extended surface tubes under varying conditions of temperature and pressure drop.

It is essential that equipment which is of vital importance to the successful operation of the reactor should be thoroughly tested under reactor operating conditions before it is installed. A number of prototype units are therefore undergoing tests in the Erith laboratories. These units include sections of the charge and discharge equipment, control rod operating mechanisms, gas selection valves, special gas seals for carbon dioxide blowers, mechanical and electrical drive units operating in hot carbon dioxide, and bearings which will have to be run in hot gas without conventional lubrication.

Tests are also being carried out on pneumatic motors, driven from a compressed air supply, running in a furnace under carbon dioxide pressure and at temperatures up to 200 deg C.

Electronic Simulator

The electronic analogue computer is claimed to be the largest and most advanced of its type in the country to be used exclusively for nuclear power studies. Initially, the simulator will be used in the study of transient phenomena occurring in a nuclear power station following disturbances such as fault conditions, and in the analysis of automatic control systems.

The use of an electronic analogue enables the behaviour of a particular unit or group of units in the plant to be predicted accurately and quickly without the need for long and laborious calculations. A simple example would be the variation in reactor power with movement of the reactor control rods. By setting the appropriate voltages on one section of the computer, the electrical circuits can be made to simulate the behaviour of the actual equipment and the results obtained in a matter of minutes as graphs on the recording instrument. More complex problems, involving the interdependence of several sections of the plant, can be dealt with equally well, with an even greater saving of time and effort.

The computer is so designed that it will be equally useful in the investigation of more advanced forms of reactor than the gas-cooled, graphite-moderated type now under development. As it can operate either as one large machine or as two completely independent smaller machines, it is possible to examine simultaneously two entirely separate problems.

In many of the problems encountered the time scale is likely to vary from a fraction of a second to several hours. The computer normally operates in real time, and the performance of any section of the power station can be examined from the traces of two continuous high-speed pen recorders which allow four variables to be recorded simultaneously. Alternative indication of each section is provided by a cathode-ray oscilloscope. With real time working, actual units of control systems can be coupled into the simulator circuit and their behaviour analysed. For longer-term problems, such as the effects of xenon poisoning of the fuel, the rate of working can be accelerated.

The analogue computer designed to simulate the performance of any part of a nuclear power station

The computer consists of eight cabinets, arranged in "L" formation with the control cabinet at the junction. One special cabinet is permanently connected to simulate the nuclear reactor itself, and the remaining six are identical general purpose cabinets which can be set up to simulate the performance of heat exchangers, control rods, blowers, turbo-alternators or other components of the power station plant. This arrangement allows the equipment to be used with a high degree of flexibility, and will make it possible for a wide variety of problems to be studied.

Provision is made for the incorporation of 100 drift-connected amplifiers and 20 servo-multiplier units. At present 84 amplifiers are available, any one of which can be used as a summing amplifier, integrator, or servo amplifier. Two transit time units are provided for the simulation of time delays, the output signal of each unit being the input signal delayed in time.

The simulator was manufactured by the Nuclear Division of Elliott Bros., who also collaborated with the G.E.C. in the design of the machine. In use it has demonstrated the complete inherent safety of the plant under all possible fault conditions.

Electric Glass Production

TO assist in meeting the increased demand for glass bottles of a wide variety of shapes and sizes, the United Glass Bottle Manufacturing Co., Ltd., has recently put into operation at its Charlton Works an electric boost melting system on one of the regenerative type furnaces. Although the system, known as the Penberthey boost melting three-phase system, has increased the capacity load of this particular furnace by 30 tons of glass per day without increasing its size, this is not the sole reason for its introduction: glass produced by this means has also proved to be of a much better quality. The supply of electrical equipment for the control of the boost melting furnace was carried out by the Plant Division of Crompton Parkinson, Ltd.

Basically, the system takes advantage of the fact that when glass gets hot it becomes highly conductive. Electric power derived from three single-phase Crompton Parkinson transformers is fed into the furnace via water cooled molybdenum electrodes, each operating at a maximum current rating of 2,000 A per electrode, in this instance. The current applied is in accordance with the load conditions of the furnace, which range from 100 kW to a maximum load of 630 kW, and the furnace is rated at 5 tons of glass per 100 kW approximately.

By passing high currents through these electrodes, which are inserted through the refractory side walls of the furnace, the molten glass receives its maximum temperature boost. In this way heat is liberated within the glass itself tending to give good glass melting conditions. In the area of molten glass adjacent to the electrodes, convection currents are created, which energise the glass and assist in the "fining" process. The electrode method, in contrast to other firing methods, ensures that heat is directed to the region of the furnace where the highest temperature is required.

After electric boost melting the molten glass travels through a throat to the working end of the furnace where it is distributed by channels to bottle making machines of the suction and flow type, and after annealing the bottles proceed to the sorting department, after which they are either processed to meet customers' requirements, or sold direct.

The furnace transformers are Crompton Parkinson single-phase indoor units, each of 250 kVA, stepping down from 9,900/11,550 V in six steps, to a secondary voltage variable between 75 and 346 V, with a maximum 250 kVA available at any voltage. The incoming supply, at present 10 kV nominal, will be altered to 11 kV nominal at some future date. Two off-circuit externally operated tapping switches select the incoming and outgoing voltages respectively. All tappings are situated on the h.v. winding and external linking arrangements on the l.v. winding provide series-parallel connections and also connect the three units in either delta or star depending on requirements. The transformers are designed for a lower temperature rise than standard and the cores are built of cold reduced oriented steel. An earth shield is also fitted between windings, as the method of furnace operation precludes a direct earth on the secondary windings under certain conditions. Although it is a three-phase unearthed circuit on the l.v. side of the transformers, an earthing electrode is inserted at the working end of the furnace which reduces to the minimum the potential of glass at the bottle making machine pick-up point. The electrode is connected to large cast iron plates in the ground which are in turn bonded to the bottle making machines.

Operation of electric boost melting on this furnace is extremely simple and flexible, relying as it does on the use of simple tapped transformers which are able to provide sufficient voltage range, even allowing for variation of resistance with temperature. Variation in electrical resistance of glass with temperature is great and is one reason why flexibility in voltage available at the electrodes is required. In order to ensure the safety of the unskilled operator, the oil circuit-breaker controlling the h.v. supply to the transformers is arranged for remote operation from a floor fixing l.v. control cubicle situated adjacent to the furnace. The solenoid closing gear of the o.c.b. is designed for operation from a d.c. supply.

The electric boost melting system, which has been in operation for nine months, has proved extremely successful in keeping pace with present-day production demands.

City and Guilds Courses

THE City and Guilds of London Institute, Gresham College, has published "New and Revised Schemes for the Session 1956-57." It covers broad courses for various trades and professions, as well as examination dates and times and regulations and syllabuses. Programme C (electrical) deals with the following courses etc.: No. 57—electrical technicians; No. 58—electrical fitters; No. 59—light current electrical engineering inspection; and No. 113—illuminating engineering.

Course No. 57 is for electrical technicians engaged in the design, manufacture, testing, erection and maintenance of electrical plant and equipment. The field covered embraces plant and machinery, power generation and supply, and industrial electronics, whilst provision is being made for those engaged in electrical drawing offices. The four-year course leads to an electrical technician's certificate which will be endorsed by the Institution of Electrical Engineers and the City and Guilds of London Institute.

The new course for electrical fitters will occupy three years of part-time study, with attendance of approximately 200 hours during each year. The subjects to be studied are electrical trades theory and laboratory work, drawing and calculations (with mechanics), and electrical trades workshop practice. The Institute will examine in the first two, but in electrical trades workshop practice colleges will be asked to certify that a candidate has satisfactorily covered a syllabus and to award a mark for each year of practical work.

Examination in light current electrical engineering inspection will be offered by the Institute and will include sections on the general introduction to light current electrical engineering inspection, electronics and telecommunications (common portion), line telegraphy and telephony, radio and radar.

VIEWS on the NEWS

By REFLECTOR

NOW that the season of dinners with their welter of oratory is quickly approaching I feel that I should enter my annual plea for brevity—of both toast lists and the items composing them. In doing this I may recall some reminiscences of Sir Frederick Bramwell introduced by Sir Ambrose Fleming in his *Memories of a Scientific Life*. Bramwell was celebrated for his dry humour and impressive personality, and as a speaker, whether at a public dinner or scientific function, he was unsurpassed, said Sir Ambrose.

"Attending once at a dinner at Peterhouse College, Cambridge, to celebrate its six-hundredth anniversary, he is said to have been called upon at about 11 p.m. to propose the toast of 'Applied Science.' Rising slowly, he said that 'at that hour of the night the only application of science which seemed to him at all relevant would be the application of the domestic lucifer to the bedroom candle' and he sat down. The American Ambassador wrote on the back of his menu card and pushed across to him the impromptu lines:—

'O wise Sir Frederick!
Would that all could catch
Your charming brevity
And find your match.'"

* * *

Last week I quoted a heading "Friendly First Aid Practices." In another Electricity Board magazine (*Eastern Electricity*) I find the following:—

"The scene set for the competition was a crowd round a bar at a small club. Others seated at tables are partaking of refreshments. Heated argument round bar leads to blows. Broken bottle being used by man involved. . . . Injuries: Man with severe wound on face. Collis fracture of wrist and burst varicose vein. Second man with fracture of jaw. Hysterical girl."

I trust that affairs of this kind are rare at the Board's establishments.

* * *

I reproduce the following piece of scientific explanation from the *Manchester Guardian*:—

Asked, in his English Literature paper to comment on the prodigies seen by Casca on the eve of Caesar's assassination, an up-to-date G.C.E. candidate writes: "A slave of Cicero's had held up his right hand while standing in the market place. His arm had appeared to be burning 'like twenty torches joined,' yet without being burned. This of course was the result of static electricity."

* * *

Recently I referred to the inability of a Salisbury consumer to obtain an electricity supply owing to the "credit squeeze." I gather from the *Aldershot News*, however, that there is one way of overcoming the delay. At the local offices of the Southern Electricity Board a would-be consumer was told that she could have her house wired for electricity, which the Board was quite willing to do for her, but it might be years before the house was connected to the supply. That would depend on when the restrictions ended. By having it ready wired, there would then be little delay in connecting up. The applicant was informed, however, that she could have electricity if she produced a doctor's certificate that she was allergic to gas. In that case, as the writer of the note points out, the removal of the gas cooker would be an obvious necessity.

* * *

When a new borough electrical engineer was appointed by the Blackpool Corporation sixty years ago he found the local undertaking in a parlous condition. In a report which he presented to the Lighting Committee (reproduced in the *Electrical Review* of 21st August, 1896), the engineer, Mr. R. C. Quin, said that the Committee was well advised to install the high-pressure alternating current system but

"none of the engines and dynamos can be termed highly efficient, and the committee cannot but regret their choice when the large area required, and the large outlay needed for buildings to accommodate that particular type are taken into consideration. At the same time he does not recommend their replacement, seeing the very large amount of capital such a course would entail. In regard to the mains, he says cables have been rammed and jambed into the pipes until there is an average of six cables per pipe, and if one breaks down the whole lot will follow suit. The high tension rubber cables have perished on all sides, and must be replaced by more lasting ones, and different methods adopted in laying them. The arc-lighting cables are similarly situated; in fact he does not think there are 100 yards out of the 11¼ miles laid which is worth more than its price as scrap copper. The repeated street-lighting failures are evidence of this deterioration; and the breakdown of one cable, in nine cases out of ten, means the burning asunder of the other cables in the same pipe. He attributes these failures to the action of the salt water, and he recommends the entire replacement of the cables by lead-covered ones laid in asphalte a foot beneath the surface of the pavement. The defects of the street boxes are noted, and the sheer luck which has alone prevented accidents similar to those at London and Bournemouth."

* * *

What are the "electric booster units" now apparently being employed in Dublin public houses? The *Irish Times* reports that they have caused some concern among old Dubliners in recent months because it is feared that "the traditional handpulls from which pints of stout and beer are drawn are on their way out." From an explanation given by a member of the "trade" it would seem that the units are used to impart pressure to the liquid because "it was not possible, with the old casking and hand pumping systems, to draw a pint of the lighter gravity ale or stout so that it would have the appearance of the old heavy gravity drink." Old hands would say, no doubt, that it was too weak to move by itself.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Readers will learn with regret that **Dame Caroline Haslett,** D.B.E., Companion I.E.E., has retired from the Central Electricity Authority upon completion of her term of office. Dame Caroline had been a part-time member of the Authority since its establishment in 1947. She has been in ill-health for some time and recently found it necessary to relinquish the directorship of the Electrical Association for Women of which she was the founder.

Dame Caroline Haslett

Mr. E. H. L. Cooper, M.I.E.E., M.I.Mech.E., has been appointed managing director of A. C. Morrison (Engineers), Ltd. He is relinquishing his appointment of works director and general manager of Henry Meadows, another company in the Associated British Engineering Group. Mr. Cooper served an apprenticeship with John Fowler & Co. (Leeds), Ltd. He was a student at Leeds University under Professor Goodman. He subsequently held progressively important executive appointments in electrical manufacturing and internal combustion engine concerns, including British Thomson-Houston Co., Ltd., Davey Paxman & Co., Ltd., and Crompton Parkinson, Ltd. Before joining Henry Meadows, Mr. Cooper was managing director of two companies in the John Brown Group.

Mr. E. Tankard has been appointed comptroller of the Metropolitan-Vickers Electrical Co., Ltd., **Mr. A. Cooper,** B.A.(Com.), A.C.W.A., accountant, and **Mr. A. G. Evans,** A.C.A., assistant accountant.

Mr. Tankard succeeds **Mr. E. Salmon,** who has retired from the company. He joined the M-V Company in 1913 and had been chief accountant since 1951. He served with the Forces in India from 1916 to 1920, and he acted as the company's site accountant on the Montevideo power station contract during 1930-32.

Mr. Cooper took his degree at Manchester University and joined the company in the Comptroller's Department in 1937 and had been assistant accountant since 1951.

Mr. Evans served articles with a Manchester firm of chartered accountants and joined the M-V Accounting Department in 1923. After holding various positions he was appointed internal auditor in May last.

The Midlands Electricity Board announces three appointments on the staff of the headquarters department controlled by its chief commercial officer, Mr. H. J. Gibson, B.Sc., A.C.G.I., M.I.E.E. **Mr. J. H. Addenbrooke,** M.I.E.E., formerly assistant chief commercial officer responsible for development, has been appointed deputy chief commercial officer. He will be directly responsible to Mr. Gibson and will act on his behalf in his absence. **Mr. G. W. Abbott** will continue in a consultative capacity and will carry out duties in respect of tariffs and heavy industrial supplies as hitherto.

Mr. F. C. Duffield, A.M.I.E.E., formerly a senior assistant in the Commercial Department, has been appointed assistant chief commercial officer responsible for industrial and commercial development and also for appliance testing. In his new appointment he will concentrate on experimental work designed to help industrial and commercial consumers to develop and improve electrical methods of carrying out existing and new processes.

Mr. E. C. Cooper, A.M.C.T., A.M.I.E.E., Walsall district engineer, has been appointed, from 1st September, to the staff of the Commercial Department as a senior assistant engineer in the tariffs and development section, where he will be concerned with system development and public lighting.

Mr. Addenbrooke was educated at Wolverhampton Grammar School and received his early training with the Electric Construction Co., Ltd., Wolverhampton, and with Wolverhampton Corporation Electricity Supply Department. Subsequently he was assistant consumers' engineer at Wolverhampton, sales manager in the Sheffield Electricity Department and commercial assistant with the former Shropshire, Worcestershire and Staffordshire Electric Power Co. He was appointed section head of the development section of the M.E.B. in 1948 and later assistant chief commercial officer (development).

Mr. Duffield served his apprenticeship with Vickers Armstrongs. In 1936 he joined the staff of Birmingham Corporation Electric Supply Department and held progressive appointments. On nationalisation he became a senior assistant engineer in the Commercial Department of the M.E.B.

Mr. Cooper began his career with the Metropolitan-Vickers Electrical Co., Ltd., and held appointments with Sheffield and Bedford Corporations and the Eastern Electricity Board before becoming district engineer at Walsall in 1952.

The Metropolitan-Vickers Electrical Co., Ltd., announces that **Mr. R. M. A. Smith,** B.Sc.(Eng.), M.I.E.E., has been appointed sales manager, Instrument and Meter Department, and **Mr. A. H. Gray,** M.Sc., M.I.E.E., assistant chief engineer of the Department. Mr. Smith succeeds **Mr. R. H. Knott,** who will act in an advisory capacity. He received his technical training at the Polytechnic and took his degree at London University. After a college apprenticeship at M.-V. he joined the Instrument and Meter Engineering Department in 1936, where he specialised in the design of automatic control schemes, protective gear, and "Ripplay" centralised control. In 1950 he transferred to the Instrument and Meter Sales Department and was appointed assistant sales manager in 1952. Mr. Smith has visited many countries overseas on behalf of the company, and he was jointly awarded the Sir John Snell Premium of the I.E.E. in 1949 for a paper on "Centralised Ripple Control on H.V. Networks."

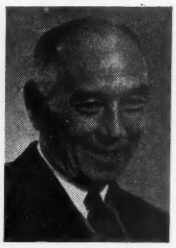
Mr. R. M. A. Smith

Mr. A. H. Gray

Mr. Gray received his technical

Mr. E. Tankard

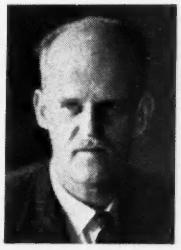
Mr. A. Cooper



Mr. A. G. Evans

education at Leeds University, taking an M.Sc. degree in 1921. He joined M.-V. as a college apprentice in the following year, and on completion of his course joined the Instrument and Meter Department. In recent years he has been engineering section leader in charge of regulator and turbovisory gear. He is author or joint author of a number of papers, the most recent being "The Electrical Measurement of Steam Turbine Rotor Movements," written in conjunction with Mr. J. L. Ashworth and Mr. J. S. Hall, which was read before the I.E.E.

Mr. G. E. Adams, who has been associated with electricity supply in Bedford for the past twenty-eight years, has been appointed district engineer at Bedford with the Eastern Electricity Board, in succession to **Mr. A. A. Nimmo** who has retired. Mr. Adams was born in Bedford and attended the Bedford Modern School from 1921 to 1928. After practical training in the Bedford Electricity Department he became a mains assistant. In 1943 he was seconded to the Air Ministry as station engineer at an American bomber station, returning to the Corporation at the end of 1945. In 1950, he was appointed first assistant engineer at Bedford for the Eastern Electricity Board.



Mr. G. E. Adams

Mr. B. A. Ricketts has been appointed manager of the Newcastle-upon-Tyne branch of Thomson & Brown Brothers, Ltd., in succession to the late Mr. G. W. Urwin. Mr. Ricketts has been assistant manager at Newcastle for many years.

Mr. D. G. Hollis, A.M.I.E.E., sales manager of H. D. Symons & Co., Ltd., accompanied by **Mr. C. J. Levitt,** of the company's London exporting house, Cooper Findlay & Co. (London), Ltd., will be leaving for Scandinavia on 29th September, when they will visit Oslo, Stockholm, Helsinki and Copenhagen. They expect to return to London on 12th October.

Mr. J. G. Jackson, previously acting manager of the Newcastle District Office of the Edison Swan Electric Co., Ltd., has been appointed manager. He joined Edison Swan in January last, having previously been with Enfield Cables, Ltd., as branch manager at Newcastle and then Glasgow.

Mr. J. G. Jackson

The Micanite & Insulators Co., Ltd., announces that **Mr. R. F. Archer,** joint general manager, has been elected to the board of directors. **Mr. H. N. Sporborg** has resigned from the directorate.

Mr. C. N. Kington, M.B.E., B.Sc., M.I.Mech.E., M.I.E.E., has resigned his post as group manager of the British Iron and Steel Research Association's Sheffield Laboratories, director of Research of the Cutlery Research Council, and research superintendent of the File Research Council to become chief mechanical and electrical engineer with Messrs. Husband & Co., consulting engineers and architects. He will take up the appointment on 3rd September.

Mr. Kington is an honours graduate of Birmingham University and received his early training in the sound broadcasting and telecommunications fields. He served throughout the war in the Technical Branch of the Royal Air Force and commanded various engineering units including one which was concerned with some of the first jet aircraft to go into service. In 1946 he joined the London office of the British Iron and Steel Research Association and in 1947 was transferred to Sheffield to take local charge of the design, erection and administration of the Association's laboratories. He was awarded the M.B.E. in 1943 for engineering work during the defence of Malta and subsequent invasion of Italy.

Mr. W. B. Fenwick, M.I.E.E., M.I.I.A., has been appointed deputy works manager of A. Reyrolle & Co., Ltd., as from 1st September. Mr. Fenwick served his apprenticeship with the company and after works and drawing office training was attached to the Contracts Department. Following specialist responsibilities from 1940 to 1946, he became head of the Power Supply Switchgear Division (Home Contracts) and in 1951 was appointed East Midlands area manager, establishing new offices in Nottingham.

Presentations of silver cigarette boxes were recently made by Mr. W. Glass, managing director of Johnson & Phillips, Ltd., to commemorate fifty years' service with the company. The recipients were **Mr. S. A. Steel,** a fitter in the Junction Box Department, and **Mr. S. A. Simmons,** foreman of the Jig and Tool Department. Mr. G. T. W. Whitehead, works director, Mr. F. C. Holliman, manager of the Employment and Welfare Department, together with the managers of the departments concerned, Mr. C. J. H. Stevens of the junction box section and Mr. S. Treen of maintenance, were present and added their congratulations.

Mr. W. H. Stephenson, A.M.I.E.E., M.I.Ex., has been appointed export manager of the London Electric Wire Co. & Smiths, Ltd., and its associated companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., and the Vactite Wire Co., Ltd. Mr. Stephenson was previously export manager with Mersey Cable Works, Ltd.

The Sir Alexander Roger Travelling Scholarship instituted by British Insulated Callender's Cables, Ltd., as a tribute to its first honorary president, has been awarded this year to **Mr. J. R. Pugh,** assistant to the chief traction engineer, British Insulated Callender's Construction Co., Ltd.

Mr. J. R. Pugh

Mr. Pugh, who is a B.A. (honours) (mechanical science tripos), Cambridge, joined the company in 1948 as a graduate apprentice. His apprenticeship course completed, he was appointed to the traction section of the company where he has worked on the technical aspects of railway electrification schemes.

He will use the scholarship to visit Germany, Austria, Sweden and France to study the design, erection and performance of high voltage a.c. traction equipment.

Mr. H. F. Carpenter, C.B.E., F.C.I.S., F.S.A.A., chairman of the Electricity Authority of Cyprus and a member of the South Eastern Electricity Board, has been appointed a vice-president of the British Electrical Development Association, in recognition of his services to the Association and to the electricity supply industry.

Mr. J. E. Francis has been appointed buyer for Martindale Electric Co., Ltd. He was previously with the Rootes Group.

In our last issue we announced that **Mr. C. J. V. Lawson,** M.I.E.E., M.I.R.E., will become engineer-in-chief of Cable & Wireless, Ltd., on 1st April next, in succession to **Mr. J. A. Smale,** C.B.E., A.F.C., B.Sc., M.I.E.E., who is retiring at the end of March. Mr. Lawson becomes deputy engineer-in-chief on 1st September and will work jointly with **Mr. W. J. Knight,** M.B.E., until 31st December next, when Mr. Knight will be retiring.

Mr. C. J. V. Lawson

Mr. Lawson is fifty years of age and was born at Kinsale, Co. Cork. He was educated at Brondesbury School, London, and at St. Paul's School, Kensington. He joined the Eastern Telegraph Co. in June, 1923, as telegraph operator, but he was later dual-trained as a cable and wireless engineer. For the next fifteen years

he served at a number of cable and wireless stations in various parts of the world.

Mr. Lawson was in charge of the installation work on the emergency wireless station at the cable station at Porthcurno, near Land's End, as a precaution against disruption of Porthcurno's landline communications with the London Telegraph Station during the war, and he was responsible for a new beam wireless relay station at Colombo. In the next few years he carried out installation work at Massawa and Asmara (Eritrea) and Accra on the Gold Coast, and in 1947 went to Barbados as installation engineer during the extension of the wireless relay station there. In 1949 for three months he was a technical adviser to the British Delegation to the International Telecommunications Union in Washington. Later he was successively area engineer on the staff of the divisional manager, West Indies, manager, Bermuda, and manager, Porthcurno (1954).

Mr. Knight was born at Lockerley, Hampshire, in 1896, and was educated at Warminster Grammar School, Wiltshire. He joined the Western Telegraph Co., Ltd., in 1915 and transferred to Cable & Wireless, Ltd., on its formation in 1929. He was appointed assistant engineer-in-chief of Cable & Wireless, Ltd., in 1951, and deputy engineer-in-chief in 1955.

Mr. J. Moss, B.Sc., author of the article on cellular polythene published in this issue, graduated from Manchester University in 1943 and from then to the end of 1947 he served in the R.A.F. as a technical radar officer. After a short period as a physics master he joined the Research Centre of the Dunlop Rubber Co., Ltd., as a research physicist. Some three years ago he took up his present position as a development engineer with the Plastics Division of British Insulated Callender's Cables, Ltd., at Helsby, where he has concerned himself with problems associated with the development and production of plastic cables.

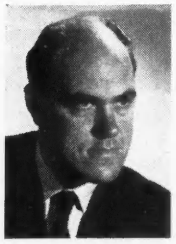
Mr. J. Moss

ELECTRICAL WHO'S WHO

The 1956-57 edition of the "Electrical Who's Who" is now available from Iliffe & Sons, Ltd., Dorset House, Stamford Street, S.E.1. This edition has been considerably enlarged and contains some 7,000 entries in addition to the index in which names in the biographical section are classified under companies or other organisations. The price remains at 21s (postage 1s 5d)

We are glad to hear that **Mr. N. Hunter,** M.I.E.E., formerly borough electrical engineer and manager at Stockton-on-Tees and now commercial engineer there, is convalescing after his recent illness. He thanks all those who have sent him their kind wishes.

Mr. O. T. Evans, Assoc.M.C.T., A.M.I.Mech.E., A.M.I.E.E., was appointed assistant chief engineer (mining), Electrical General Engineering Department of the Metropolitan-Vickers Electrical Co., Ltd., on 1st July. Mr. Evans was educated at the Treforest School of Mines, Cardiff Technical College and the Manchester College of Technology. After experience with Baldwins Colliery, Ltd., South Wales, he went in 1923 to Trafford Park as a school apprentice and mining trainee. Thereafter he joined the Mining Division of the General Engineering Department and since 1953 he has been responsible for mining development projects. Mr. Evans has presented many technical papers to the Association of Mining Electrical and Mechanical Engineers and has visited South Africa, Rhodesia, France, Germany, Holland and Belgium on mining business.



Mr. O. T. Evans

Mr. R. G. Middlemiss, M.I.E.E., has been nominated construction engineer of the London Electricity Board from 1st August. He was formerly head of the substation construction section, and before vesting day was with Central London Electricity, Ltd.

Mr. C. Marshall, Philips lamp representative for North Lancs. since 1929, retired on 30th July last after thirty years' service with the company.

The Scottish Branch of Permanoid, Ltd., at 14, Gibson Street, Glasgow, W.2, is now under the management of **Mr. G. G. Littlejohn.**

OBITUARY

Mr. J. N. Thornton.—The death occurred suddenly on 8th August of Mr. J. N. Thornton, section engineer (transmission), Yorkshire Division, Central Electricity Authority. Born in 1892, Mr. Thornton was educated at Mirfield Grammar School and continued his studies at Manchester Technical School, Manchester Wireless Telegraph School and Manchester University. He entered the electricity supply industry in 1914 as an assistant with the Hendon Electric Supply Co. From 1915 to 1919 he served in the army as a wireless operator and saw service in France. On his return to civilian life he joined the Yorkshire Electric Power Co. and was concerned with overhead construction and maintenance work until 1930 when he became a wayleave officer in the Mid-East England Area of the Central Electricity Board. In the same year he was appointed section engineer.

Mr. J. G. Adamson.—The death has occurred in hospital at the age of eighty-four, of Mr. John Gibson Adamson, director and a founder of Adamson, Green & Co., Ltd., electrical engineers and switchboard manufacturers, of Felling-on-Tyne. Mr. Adamson retired from active business two years ago.

Mr. J. L. Florence, director of the Z Electric Lamp & Supplies Co., Ltd., died on 16th August at the age of fifty-eight. His service with the company began in 1924. He became a director in 1939 and was appointed managing director in 1948, relinquishing that position last year on account of ill-health. He remained on the board in a consultative capacity.

Mr. J. W. Rodger, M.I.E.E., managing director of Bruce Peebles & Co., since 1946, died at a nursing home in Edinburgh on 16th August. Mr. Rodger was born at Warrenpoint, Co. Down, in 1887 and was educated at Bolton Technical School, Manchester School of Technology, Belfast Technical College and at the Finsbury and Goldsmiths' Colleges, London. After training with Paterson Cooper & Co., Paisley, and Royce, Ltd., Manchester, he was for a time with Johnson & Phillips, Ltd. He then served as chief transformer designer with Ferranti, Ltd., and the Hackbridge Electric Construction Co., Ltd., until 1924 when he went to Bruce Peebles & Co., as manager and chief engineer to establish a transformer department. He became chief engineer and works manager of all the company's departments in 1933 and was appointed a director in 1941. He was also a director of Electromagnets, Ltd., and chairman of constituents of Bepco Canada, Ltd.

The late Mr. J. W. Rodger

Mr. Rodger was actively interested in a number of industrial and educational bodies. He was a governor of Heriot-Watt College, Edinburgh, and a member of the Regional Advisory Council for Technical Education in S.E. Scotland. He was also a member of the B.E.A.M.A. Council and president of the Scottish Engineering Employers' Association. He had travelled widely on behalf of his company.

Mr. Harry Norman Booth, principal of Booth & Son, Manchester Street Oldham, dealers in electrical fittings died on 4th August at the age of sixty-eight.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Technical Qualifications

A GREAT deal has been said on the subject of providing technical training so as to fit technicians and engineers into industry in sufficient numbers for industry's needs. Has enough attention been paid, however, to the responsibility of employers to encourage personnel to acquire qualifications? This could be done by a virtually automatic increase in salary when an approved qualification has been attained.

What is badly needed is a grading of qualifications in industry, particularly on the engineering side. The B.B.C. have, I believe, a grading of this kind for their use but not for outside publication.

It would be difficult to compile a grading of the various examination qualifications, but it is very desirable that somebody should take on the job. Perhaps the best method would be for an appropriate body to compile a grading and circulate it to the examining bodies concerned and consider any objections which may be raised.

Where qualifications are regarded by the employer as necessary to the job, the Inland Revenue will generally concede that the annual subscription can be allowed against income tax.

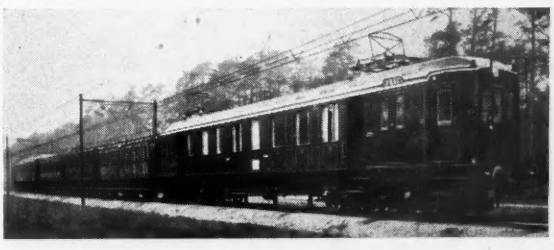
"UNQUALIFIED."

Electric Railway Traction

IN his article on this subject in the *Electrical Review* of 18th May last (p. 819), Mr. B. K. Cooper says:—

> "The desire to take advantage of high-voltage a.c. distribution to the trains, while avoiding three-phase difficulties, led to the study of single-phase traction systems. In the first example of single-phase railway traction, on the Seebach-Wettingen line in 1904, the original locomotive was supplied from the contact wire at 15 kV, 50 c/s, and carried a motor-generator set to give a 600 V d.c. output for the two 200 h.p. traction motors."

The author is evidently not aware that the Berlin suburban line Niederschöneweide-Spindlersfeld had already been electrified by the A.E.G. in 1903 as the first single-phase a.c. railway. The experimental railway was operated successfully for two years. Two passenger coaches of the Prussian-Hessian railway administration were converted into electric overhead motor coaches. Each motor coach was driven by two single-phase a.c. commutator motors. These were compensated repulsion motors made according to the patents of the A.E.G. engineers Winter and Eichberg and the experimental line was operated with single-phase a.c. 6,000 V, 25 c/s.



This is claimed to have been the first single-phase motor coach train. It ran on the Niederschöneweide-Spindlersfeld line in Germany

Furthermore, a.c. traction was used for the first time on the rail coaches, and on the line multiple suspension of the contact wire, now called chain suspension, was applied. The single-phase motor coach train consisting of two motor coaches, driven by the first single-phase a.c. train motors, and three trailer coaches operated regularly. The train motors of the single-phase a.c. line Seebach-Wettingen in Switzerland in 1904, alleged to be the first one, were, however, still 600 V d.c. motors.

A photograph of the first single-phase motor coach train of the experimental line Niederschöneweide-Spindlersfeld is enclosed.

Berlin. STUCKHARDT,
Railway Department,
Allgemeine Elektricitäts Gesellschaft.

Machine Tool Control

THE article on machine tool control in your issue of 3rd August by Mr. C. K. Marklew was very interesting and most informative, but as an electrical control engineer I would like to make reference to his last paragraph, in which he complains of shoddy electrical control gear.

Some of the best control gear in the world is made in this country, and if this is not used by machine tool manufacturers, they only have themselves to blame. Time and time again I encounter the machine tool manufacturer who wishes to keep selling prices down by cutting the cost of the electrical auxiliaries. Such savings are always small in comparison with the cost of the machine itself, but a demand is thereby created for cheap electrical equipment, which often has not been properly designed, developed or proved in the field.

Mr. Marklew does appreciate that high quality electrical equipment is desirable, and I suggest that the answer is in his own hands; such equipment can be obtained, but not always at the lowest prices.

Hounslow, Middx. J. S. CROFTS, A.M.I.E.E.

Street Lighting—"Cinderella"

"REFLECTOR" is quite right in calling street lighting the "Cinderella" of public services. But this is not just because the Ugly Sisters (Miss Sewage and Miss Refuse) have a prior claim to go to the ball, but rather because the latter in their quaint ways benefit the borough and the borough alone, while Cinderella distributes her favours rather too liberally among all comers.

As an electrical engineer and a borough councillor, I find it very difficult sometimes, when sitting on our Works Committee, to reconcile the demands of good lighting—largely for the benefit of motorists who are not local ratepayers—with the purse of the local ratepayers.

Much as I dislike centralisation as a formula for progress, and much as I am in favour of a borough controlling its own affairs, I feel that there is perhaps a case for street lighting being made the responsibility of the County if not the Ministry.

London, W.6. D. WINTON THORPE.

INDUSTRIAL NEWS

National Inspection Council

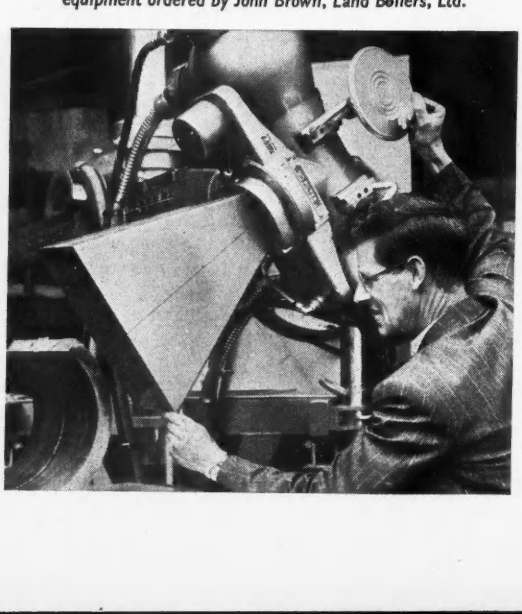
The National Inspection Council for Electrical Installation Contracting was registered on 10th August as a company limited by guarantee, without share capital. The original number of members is 100 each being liable for £5 in the event of winding up. The word "Limited" is omitted from the title by licence of the Board of Trade. The income and property of the Council, whencesoever derived, is to be applied solely towards the promotion of its objects. The management is vested in a Board the first members of which include: Mr. P. V. Hunter (director of British Insulated Callender's Cables, Ltd., etc.); Mr. C. R. King (chairman of the East Midlands Electricity Board); Mr. J. G. Briggs (director, Monmouth Estates, Ltd., etc.); Mr. A. F. Plummer (director of Shoolbred Electrical Co., Ltd.); the Institution of Electrical Engineers; the Central Electricity Authority, and others. The secretary is Brigadier W. G. S. Thompson, and the solicitors Bristows, Cooke & Carpmael, E.C.2; the registered office is at 13, Victoria Street, London, S.W.1.

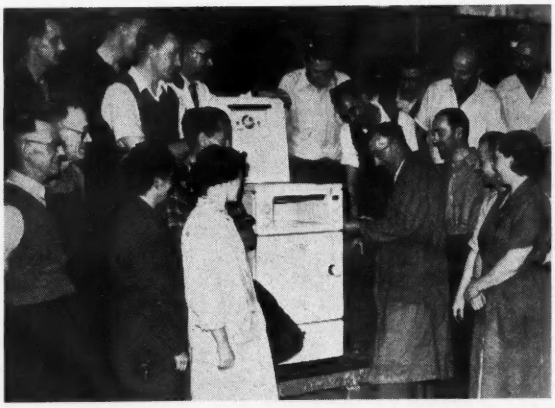
Industrial X-ray Orders

A contract for the supply of two 250 kV industrial X-ray equipments has been awarded to Marconi Instruments, Ltd., by the Ministry of Supply. The units will be installed in the Royal Ordnance Factory at Bishopton, near Glasgow. Each equipment comprises a constant potential high-tension generator, a control unit, an oil cooler, and an oil-cooled shock-proof tubehead. The voltage range, 30 to 250 kV, is sufficient for all normal applications. A special feature of the apparatus is the constant potential generator, which enables the whole of the high voltage energy to contribute to X-ray generation, ensuring maximum X-ray output and hence much shorter exposure times.

Electrically similar to the above is the Marconi 250 kV industrial X-ray equipment recently supplied to John Brown, Land Boilers, Ltd., of Clydebank. This equipment is mounted on a two-ton trailer for mobility. The control unit is installed in a lead-lined protective compartment, while at the opposite end is the tubehead and tubestand. This apparatus permits the easy radiographic inspection of welds and castings.

Factory testing of a Marconi 250 kV mobile industrial X-ray equipment ordered by John Brown, Land Boilers, Ltd.





Mr. R. Bowen and colleagues with Jackson's millionth cooker

The Millionth Cooker

An important milestone in the history of the Jackson Electric Stove Co., Ltd., was reached recently when the millionth electric cooker made by the company was produced. In the illustration shown above Mr. Ronald Bowen, who has been assembling electric cookers at the Luton works for over thirty-two years, is seen putting the finishing touches to Jackson's 46049JD—which is the cooker's service number.

Industrialists' Conference at Harwell

The United Kingdom Atomic Energy Authority is holding a conference at Harwell on 30th November at which its programme of research on advanced types of nuclear power reactor systems will be explained to representatives of British industry, and at which the salient features of the particular systems which have been chosen for investigation will be described.

Accommodation will be available for about two hundred representatives from industry. Because of the limited accommodation available it will probably be necessary to limit the number of representatives from any given firm. Requests for further details and for reservations should be made to the Director (Industrial Collaboration Office), Atomic Energy Research Establishment, Harwell, nr. Didcot, Berks, not later than 31st August.

Following this conference British firms may, if they desire, be kept informed of the general progress of work on these reactor systems. The information will be supplied at an annual conference on each system. Application for admission to this scheme should be made to the Industrial Collaboration Office, from whom further details may be obtained.

Contract Price Adjustment Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulae. In each case the rate of pay for adult male labour at 18th August is deemed to be 175s.

The "cost of materials" figures are: For electrical machinery and equipment the Board of Trade index figure published on 18th August is 183·1. For turbo-generating and allied plant: Materials used in mechanical engineering industries, 176·3; blast furnaces and iron and steel melting and rolling (40 and 41), 167·3. The price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 17th August) is 51¼d per lb.

Hanovia Window Display Competition

A national window display competition to promote the sales of its prescription lamps is being organised by the Hanovia Lamps Division of Engelhard Industries, Ltd., during the period 1st September to 9th November. The displays, which will have as the main theme "Fight Ill Health in the Home," are being divided into two main groups, electrical retailers and retail chemists. There will be three prizes in each group—1st £100; 2nd £50 and 3rd £25. The competition, which is restricted to Hanovia dealers, will be judged from photographs submitted by the entrants. The judges will be the

editors of trade journals, a representative from the company's advertising agents and the artist, Mr. Arthur Ferrier.

M.-V. Sheffield Works Extension

The Metropolitan-Vickers Electrical Co., Ltd., is to build an extension to its works at Attercliffe Common, Sheffield, where electric motors and generators are manufactured for electric and diesel-electric locomotives, multiple-unit trains, tramcars, trolleybuses and other forms of rail and road transport. The company has leased from the Sheffield Corporation a site of 21 acres for this extension, and construction of the first section will begin at once. When completed the new extension will double the existing capacity for the manufacture of railway traction motors and generators.

Works Visit

Shri Raj Bahadur, Minister in the Ministry of Communications, New Delhi, with members of an Indian party, recently visited the Strowger Works, Liverpool, of the Automatic Telephone & Electric Co., Ltd. During the tour the visitors saw some of the latest production methods in the telecommunications field, as well as the company's training facilities.

Shri Raj Bahadur (Indian Ministry of Communications), centre, at the Strowger works of the Automatic Telephone & Electric Co., Ltd. Also in the picture are Mr. Jagdoosh Prasad (managing director, Indian Telephone Industries (Private), Ltd.) extreme right, and Mr. W. S. Vick (deputy manager, works control) on the left

Among A. T. & E. executives who conducted the party were Mr. J. J. Eades, export manager, and Mr. J. A. Mason, director and manager.

Small Instrument Exhibitions

The Scientific Instrument Manufacturers' Association is issuing a document entitled "Code of Practice for the Organisation of Small Instrument Exhibitions." This contains some two dozen informal suggestions for the running of small *ad hoc* instrument displays, such as in connection with meetings, conferences, etc., which it is hoped will help the organisers of such shows.

Member firms in the instrument industry are invited to take part in many dozens of such small displays every year and have grown concerned at the great call on their time and finances and the increasing non-availability of their skilled engineering and sales staff. It has been felt reasonable, therefore, to ask exhibition organisers to co-operate with the industry—their exhibitors — in seeing that small informal displays are organised to the best advantage of all and to see that reasonable facilities are offered. This will help more firms to take part in more small shows.

Organisers of exhibitions and displays in societies, institutions, educational establishments, etc., are invited to write for copies of the Code, which is available free of charge from SIMA at 20, Queen Anne Street, W.1.

Diesel Sets for South America

Vertical diesel engines totalling 4,700 b.h.p. manufactured by the National Gas & Oil Engine Co., Ltd., and driving a.c. and d.c. generators with a total output of 3,300 kW, manufactured by the Brush Electrical Engineering Co., Ltd., Loughborough, have been ordered for four new power stations in South America, two in Colombia and two in Argentina.

Leonidas Lara e Hijos, Bogota, have ordered four F4AU7 pressure-charged engines, developing 820 b.h.p. at 514 r.p.m., each driving a 568 kW a.c. generator to supply power from two new generating stations to the river port of Magangue and the town of Zambrano on the Magdalena river in Colombia.

An F4A7 engine developing 499 b.h.p. at 375 r.p.m. driving a 344 kW d.c. generator has already been delivered to Co-operative Electricita, Ltda., Buenos Aires, and the Cia Papelera del Norte de Sante Fe has ordered a B4A6 engine developing 900 b.h.p. at 300 r.p.m. driving a 610 kW alternator for a new Argentine power station, the site of which has yet to be decided.

Switchgear for South African Steelworks

Two Metropolitan-Vickers 6·6 kV switchboards have recently been installed in connection with the modernisation of the old-established plant of Dunswart Iron & Steel Works, Ltd., at Benoni, South Africa. Both switchboards are of the V1H2R type, 250 MVA breaking capacity, the circuit-breakers being fitted with solenoid closing: a seventeen-panel board is installed in the main substation and a thirteen-panel board in the mill substation. The incoming supply from the adjacent substation of the Electricity Supply Commission is brought on to busbars, which can be seen above the incoming 1,200 A units near the middle of the main switchboard.

Seventeen-panel 6·6 kV Metropolitan-Vickers Type V1H2R switchboard in the main substation of Dunswart Iron & Steel Works, Ltd., Benoni

British Food Fair

The many uses of electricity in the kitchen—not only domestic but commercial catering kitchens—will be demonstrated on the Electrical Development Association's Stand (No. 70) at the British Food Fair which opens at Olympia, London, on Tuesday next. A "battery" of nine automatic electric cookers will simultaneously cook breakfasts, lunches and dinners, in hygienic oven glassware and foil containers. Visitors to the stand can take part in a free competition to win these meals and containers.

The new Food Hygiene Regulations call for the highest standards in commercial catering establishments. The E.D.A. stand shows how electricity can aid the caterer to comply, economically, with the Regulations. As a practical example, there will be electric dish-washing machines engaged in washing dishes and utensils for neighbouring exhibitors.

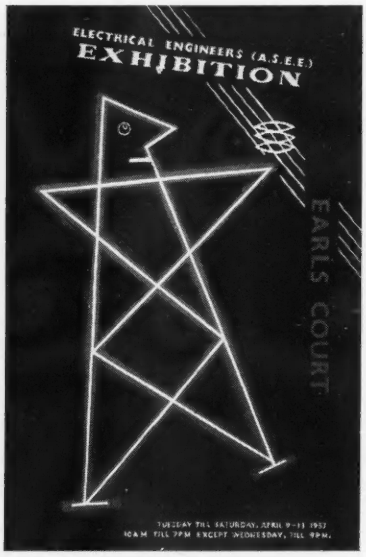
Sales Conference by Television

For the first time in this country a national sales conference was held by television. On 16th August, in London, Birmingham, Manchester, Glasgow, Bristol and Dorking, Pye dealers heard an address by Mr. C. O. Stanley, chairman and managing director of the Pye group of companies, and saw the new models which Pye has introduced at the Radio Show. The television links, covering about 600

miles, were made available to Pye by the G.P.O., the B.B.C. and the I.T.A. Three television cameras were used in the broadcast and more than 150 21in T.V. receivers were distributed between the six centres.

Exhibition Poster Competition

The accompanying picture shows the winning design in the poster competition in connection with the sixth A.S.E.E. Electrical Engineers Exhibition to be held at Earls Court, from



The winning design in the A.S.E.E. Electrical Engineers Exhibition poster competition

9th to 13th April next. The design was submitted by Mr. J. Fitzmaurice, a Birmingham art student. It illustrates an electric power pylon in animated form painted in blue with white in line on dark purple. The lines joining the lettering are in yellow representing the power cables.

New Hire Purchase Regulations

New restrictions which required initial advance payments in rental agreements for various goods were announced by the Board of Trade in February. Since then, there have been complaints from trade sources that the provisions of the Order were being avoided by traders hiring controlled goods for a short period, taking rental in advance for the short period, and at the expiration of the period substituting different but similar goods to the same hirer or in some cases re-hiring the same goods to another member of the household.

The Control of Hiring (No. 2) Order made by the Board of Trade this week is designed to prevent this evasion by making it illegal to make any hiring agreements for controlled goods for a period of less than nine months (except as noted in the following paragraph); such agreements must now be for nine months or more, or for an indefinite period. The hirer must still pay the total amount of the rental and service charges for the first nine months in advance as provided for in the original Order.

At the same time, the Order introduces a limitation to the exemption originally provided for hiring agreements under which the hirer was not in possession of the goods for more than 12 days in any period of 28 days. (This was designed to facilitate the hire of washing machines and other appliances to a number of households for one or two days a week.) The exemption now applies only if there are no agreements to hire the same goods to other persons on the same premises for the balance of the 28-day period so that is is no longer possible to avoid the Order by hiring, say, television sets to three members of a family in rotation for 11 days.

Changes have been made in the Hire Purchase and Credit Sale Agreements (Control) Order, following representations from the Federation of British Industries who pointed out that Article 5 of the Order made in February did not accord with the established practice of their members who acquire capital goods on credit terms involving progress payments during manufacture or installation, or both. The new Order regularises their position. It also amends and clarifies the exemptions for export transactions and for short term credit sales.

Copies of the Control of Hiring (No. 2) Order 1956 (S.I.1956 No. 1269) and the Hire Purchase and Credit Sale Agreements (Control) (Amendment) Order, 1956 (S.I. 1956 No. 1270) are obtainable from H.M. Stationery Office, price 3d.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £293 15s 0d
Fire Refined 99·70%	ton £292 0s 0d
Fire Refined 99·50%	ton £291 0s 0d
COPPER Tubes ..	lb 2s 11⅜d
Sheet	ton £369 5s 0d
H.C. wire and strip ..	ton £333 15s 0d
LEAD, English ..	ton £114 12s 6d
Foreign	ton £113 0s 0d
MERCURY	flask £83 15s 0d
TIN, block (English) ..	ton £764 10s 0d
ZINC, G.O.B. Foreign	ton £94 12s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 4⅛d
Sheet	ton £300 0s 0d
Wire	lb 3s 0⅛d
PHOSPHOR BRONZE	
Wire	lb 4s 6d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 28⅞d—29⅛d

Washer Competition

Wilkins & Mitchell, Ltd., have announced the result of the recent "Servis" washer "Win-a-Consul" competition. The first prize has been awarded to Mrs. O. M. Harris, of Bickley, Kent, the second to Mrs. W. O. Parsons, North Woolwich, and the third to Mrs. N. Turner, Castleton, Rochdale.

Indian Cable Contract

To improve communications in the central and suburban areas of Calcutta it has been decided to electrify certain sections of the Eastern Railway. Work on the first stage, covering the main line between Howrah and Burdwan and the branch line to Tarakeswar, has begun. British Insulated Callender's Cables, Ltd., in conjunction with their associates the Indian Cable Co., Ltd., have been awarded the contract for the supply and installation of the underground power and control cables. The total value of this contract is in the region of £250,000 and is for 33 kV, 11 kV and 3·3 kV paper insulated feeder power cables and 245 miles of control cable.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 1st September:—

RABALDO. No. 731,060. Class 7. Electric shaving instruments; and razors.—John A. Fransen, Ltd., Ryfield Cescent, Northwood Hills, Northwood, Middx.

ACHESON. No. 727,297. Class 9. Electrodes made of graphite for sale in England, Scotland and Wales.—Union Carbide & Carbon Corporation, New York, U.S.A. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

MARATHON. No. B728,904. Class 9. Measuring instruments, magnets, welding electrodes, electric contacts, cables, insulated wire and fuse wire.—Deutsche Edelstahlwerke Akt.-Ges., Krefeld, Germany. Address for service, c/o Hyde & Heide, 2, Broad Street Buildings, Liverpool Street, E.C.2.

EMP (design). No. B731,043. Class 9. Fuses, surge arrestors, lightning arrestors, and holders for fuses, all being electrical apparatus; and parts.—E.M.P. Electric, Ltd., Garman Road, London, N.17.

CONSORT. No. 752,729. Class 9. Electric vacuum cleaning apparatus.—Neptric, Ltd., 73-79, Hurst Street, Birmingham, 5.

VANESSA. No. 753,375. Class 9. Radio and television apparatus and instruments and parts.—Vidor, Ltd., West Street, Erith, Kent.

No. 753,614 (design). Class 9. Electric flat irons.—Bernard Installations (Electrical), Ltd., 32, Cheetham Hill Road, Manchester, 4.

ATOM-VAC. No. 753,911. Class 9. Electric vacuum cleaning apparatus.—Bylock Electric, Ltd., 109, South Street, Enfield, Middx.

MAGNA-GAGE. No. 754,123. Class 9. Electronic micrometers and parts.—Southern Instruments, Ltd., Frimley Road, Camberley.

VANGUARD. No. 754,149. Class 9. Radio receiving apparatus.—Burndept, Ltd., West Street, Erith, Kent.

COBRA. No. 737,382, and COBRA (design). No. 737,381. Class 11. Electric lighting fittings, electric lamps and electrically heated paint removing appliances.—Osborn Manufacturing Co., Ltd., 5/13 Highgate Square, Birmingham, 12.

MASTERMET (design). No. 742,686. Class 11. Oil and electrical heaters.—Mastermet Products, Ltd., Harrow Sheet Metal Works, Elmgrove Road, Harrow, Middx.

No. 750,435 (design). Class 11. Lighting installations.—Lumenated Ceilings, Ltd., 150, Helen Street, Govan, Glasgow, S.W.1.

CREDA STARGAZER. No. 753,568. Class 11. Electric cooking stoves and electric ovens and parts.—Simplex Electric Co., Ltd., Broadwell, Oldbury, Worcs.

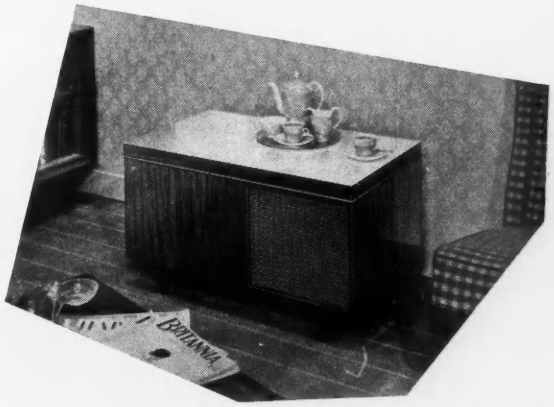
National Radio Show

TRENDS ILLUSTRATED BY NEW EQUIPMENT

By E. A. W. SPREADBURY, M.Brit.I.R.E.

A REVIEW of the new models at this year's National Radio Exhibition (Earls Court, London, 22nd August to 1st September) imparts a lively impression of a re-awakening of interest in radio receiver design, a resurgence of technical development in sound radio as distinct from television. For some years after the war design features in radio receivers stagnated, and it seemed that a stage had been reached beyond which improvements in domestic receiver design were not economic. Spectacular advances in television techniques, coupled with the novelty of receiving pictures, captured the imagination of the radio public and overwhelmed their interest in sound radio.

Mainly in the past twelve months, however, a complete revolution has taken place. The design of television receivers, outwardly at least, has become more stabilised, the principal changes being limited to circuit improvements and increased picture sizes. The most conspicuous change in television receivers is the price reductions that have been made possible by improved manufacturing techniques. Valve and cathode-ray tube prices have also been substantially reduced.

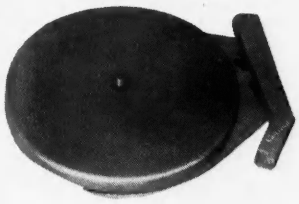


Utility is combined with a tasteful cabinet in this Marconiphone "Studio" ARG 49A A.M./F.M. automatic radiogram

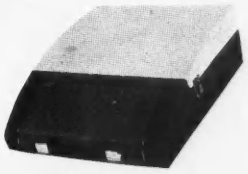
Radio receiver design has been influenced strongly by the spread of the B.B.C. frequency modulated V.H.F. radio transmissions, which are planned to cover 84 per cent of the population by the end of this year, and 96 per cent in about another year, while the introduction of transistors into domestic equipment holds the promise of an entirely new phase in the design of battery-operated receivers and associated apparatus.

The transistor is an amplifying device that has been evolved from the crystal, but it functions very much like the ubiquitous valve upon which the whole science of electronics is founded, and in some electronic applications it threatens to supplant the valve entirely. It is very much smaller than a valve and is much more efficient. It is very light, it can be run from a "high tension" supply as low as 6 V, and it requires no heater or filament current. On the debit side, it is expensive (at present), difficult to manufacture in large quantities, and very sensitive to temperature rise.

Research work has been going on for some years on transistors, but previously their applications have been limited to the industrial field. Now for the first time at



Left: This Garrard model BA1 45 r.p.m. gramophone motor for 7in records operates from a 6 V battery; it is used in a number of transistorised record reproducers



Right: A neat example of the trend towards typewriter-shaped portable carrying cases, the Alba "Cadet" 880 record reproducer

Left: The Philco portable transistorised record reproducer for 7in 45 r.p.m. records uses the Garrard 6 V motor and employs four transistors. Centre: This G.E.C. table radiogram, model BC7445, works on A.M. and F.M. radio and has a four-speed motor. Right: The E.A.R. model 1960 "Chairside," an attractively styled console record reproducer, has a pull-out playing desk at a convenient height for operation whilst seated

the Radio Show "transistorised" radio receivers are exhibited and offered to the general public. At least one manufacturer shows an all-transistor receiver, but a "hybrid" combination of transistors and valves is likely to be a more common development, because the efficiency of transistors is more marked in the audio and output stages of a receiver, and types that will work well in high frequency and intermediate frequency amplifiers are scarce.

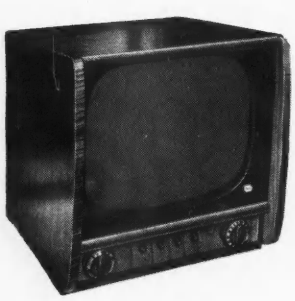
The all-transistor set works entirely from a 6 V dry battery, and consumes only a few milliamperes of current, but a hybrid arrangement needs a higher h.t. voltage than this for its valves, and a very ingenious device has been made to overcome the drawback of using large batteries.

One of the features of the transistor is that it can be made to oscillate, and this facility is used to generate h.t. current for the valves. A transistor oscillator is run from a low-voltage dry battery and its a.c. output voltage is stepped up to the desired level. A crystal is then used to rectify the output current, producing a d.c. "high tension" output at perhaps 30 V or 40 V.

This device is called a transistor d.c. convertor, and in a hybrid receiver it provides h.t. current for the valves. Thus if valves are used for the R.F. and I.F. stages of a receiver, where they work efficiently, and transistors are used for the audio and output stages, where they are most efficient, the whole receiver can be run from a 6 V dry battery, the valve filaments being connected in series and run from the same source.

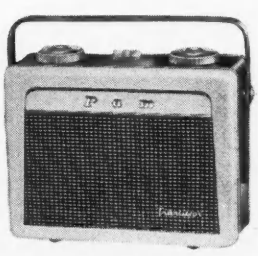
Another development in the same field is the design of a fully transistorised portable gramophone record player which runs entirely from a 6 V dry battery, using four standard U2 cells. This is made possible by the production of a lightweight battery-driven gramophone motor designed to run at 45 r.p.m., when it draws about 100 mA, and will play 1,500 records from one battery. At this very low power consumption it can drive the medium L.P. 7in record, with its very light pick-up, quite positively, and both motor and transistor pick-up amplifier run from a single 6 V dry battery. An obvious possibility is a 6 V portable radio-gramophone.

The advantages of transistors are normally limited to dry battery operation, where battery economy is of prime importance, and although no very small transistorised pocket-sized "personal" receivers have actually been marketed at the time of writing, that is a field in which they could be exploited to the fullest advantage, as they



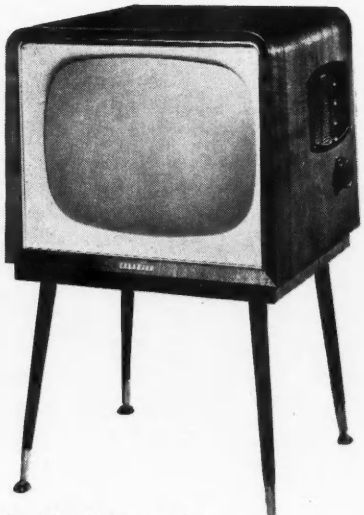
Although this Pam television receiver has a normal appearance, it incorporates a printed circuit chassis and is the first example of this type of chassis construction in this country. It has a 17in tube and 13-channel tuning

The Philco table model 1960 17in receiver, with optional legs, is equipped with V.H.F. radio, variable tone control and "finger-touch" tuning and has provision for remote control



The first transistorised radio receiver to be marketed commercially in this country is the Pam 710 portable shown here. Using eight transistors and no valves in a superhet circuit, it operates entirely from a 6 V dry battery and draws only 9 mA

This Ekco 9in model TMB 272 portable television receiver is turret-tuned for TV on Band I and Band III and V.H.F. radio (F.M.) on Band II. It is fitted with a telescopic aerial and works from a.c. mains or a car battery



Typical of the 21in table television receivers is this Ferguson model 308T. It is shown on a stand which is available as an optional extra

Continental styling is embodied in this Masteradio model RG 364 auto-radiogram, which works on A.M. and F.M. and has a four-speed motor

This tastefully styled auto-radiogram is the Ferguson 377 RG "Fantasia," with A.M./F.M. radio, piano-key tuning, three loudspeakers and a four-speed motor

have been already in hearing aids, for which they are ideal.

One type of receiver in which, although plenty of electrical power is available, the hybrid transistor system is being introduced, is in car radio, where the saving in weight and bulk is considerable. The whole receiver goes into a small case and runs from the 6 V or 12 V car battery, consuming negligible power and delivering up to 4 W of audio power output to a separate loudspeaker. No power unit or vibrator is necessary. Another excellent application is in the loud hailer megaphone which is much used in ships, where the complete transistor amplifier and its battery can easily be accommodated inside the trumpet.

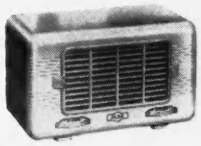
Most of the normal, that is to say not transistorised, receivers at this year's Show, and almost all the radiogramophones, can receive the B.B.C. frequency modulated V.H.F. transmissions. For the listener who lives outside the range of the projected V.H.F. coverage, or is satisfied with his present reception of M.W. and L.W. radio transmissions, there is still a wide range of non-V.H.F. receivers from which to make his choice, but the additional cost of V.H.F. is not very great, and he would be wise to choose a model that will work on V.H.F. when the service comes to his district.

A small number of receivers are marketed that operate on V.H.F. transmissions only, but the large majority will receive V.H.F. and the M.W. and L.W. transmissions as well. Listeners who are troubled by whistles from foreign stations or by electrical interference can obtain a most comforting relief by using a V.H.F. receiver, and the improvement in musical quality on many transmissions that is characteristic of the V.H.F. programme, heard against the silent background of the F.M. system, is something that must be heard to be appreciated.

Several manufacturers have taken advantage of the superior quality available on F.M. to embody in certain receivers really high quality sound amplifiers with quite elaborate speaker systems. Such models cost more than the general run of domestic receivers, but they contain properly engineered sound reproducing systems that do justice to the best radio programmes and modern gramophone records, and they satisfy the most fastidious taste. These are in the so-called "Hi Fi" class.

"Hi Fi" enthusiasts—keen gramophiles and music lovers—are well catered for by manufacturers generally. Several companies market separate high quality sound amplifiers and very special loudspeaker systems, including quite large electrostatic speakers, while others specialise in high-class components for the amateur who prefers to build his own amplifier, for which some excellent constructional

Left: The Philips table model G 64A is designed for A.M. and F.M. reception; it has piano-key tuning and incorporates a special anti-radiation circuit on F.M.



One of the smaller sets for occasional use, the Alba "C116 Midget," measuring only 8in by 4in by 4in, has a T.R.F. circuit for a.c./d.c. mains

Vidor and Ever Ready have both produced a battery-operated A.M./F.M. receiver to work on the V.H.F. transmissions. This one is the Vidor CN 436 "Vanguard" and is portable

designs are published. The loudspeaker units are usually housed in special acoustical cabinets of quite intricate construction, with slots, cavities and lagging all scientifically designed and in some cases of very handsome external appearance.

Receivers and radiograms are often fitted with several speakers, usually consisting of a combination of moving coil and small electrostatic units. This results from Continental influence, which has also led to a "new look" in cabinet finishes. These are either very dark and highly polished like a piano finish, or very light, but in either case relieved with metallic gilt lining near the edges.

Most radiograms now have four-speed motors, the fourth being 16⅔ r.p.m. although so far no records running at that speed are available. There is a large selection of table radiograms, and portable record reproducers are numerous, both transistorised and valve operated.

All television receivers shown now have multi-channel tuning for B.B.C. programmes on Band I and I.T.A. pro-

grammes on Band III, most of them using the rotary turret switch-type tuner, and with the exception of one or two special models, 14 inches (measured diagonally) is the minimum size of cathode-ray tube. By far the most popular tube size is now 17in. Out of upwards of 200 models in the Show, well over half have 17in tubes, the remainder being fairly equally divided between 14in and 21in tubes, although there are still a few projection receivers. Two manufacturers offer armchair remote control extensions.

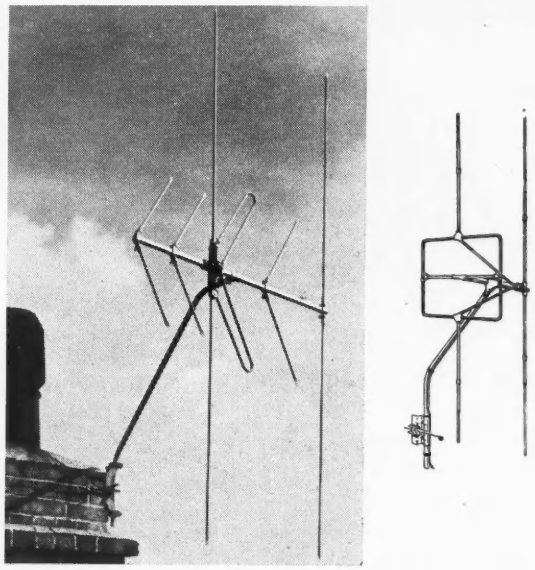
Manufacturing economies have enabled the prices of television receivers to be lowered, 14in table models averaging just over £65, with the cheapest one at £60; 14in consoles average just over £75, the cheapest being £70, and 17in table receivers are about the same, while 17in consoles average about £95, but here the cheapest is as low as £81.

Gaining rapidly in popularity are the 21in models, which a couple of years ago would have been considered outsize. Just under 50 models are shown and their prices average £100 for table models and £130 for consoles. The cheapest examples are £90 and £103 respectively.

Advances in manufacture include progressive steps of automation in the factories, which are not evident in the specifications of the receivers, but a number of other features are detectable. One of these is electrostatic focusing, a development of cathode-ray tube design which permits the external focus magnet to be dispensed with. Another is the adoption of the printed circuit technique, which has now passed out of the experimental stage and is used in a number of radio and television receivers, particularly in association with transistor assemblies.

Cabinets constitute an expensive item in the make-up of a receiver, and with increasing picture sizes they tend to become unwieldy. Their cost and bulk are kept down to the minimum by careful design, and this is aided by the rectangular shape of modern c.r. tubes. A number of large table receivers this year are available with removable legs as an optional extra, which permits them to stand on the floor like a console receiver.

Several manufacturers now include F.M. radio positions on the turret tuner of their television receivers. This is a logical development, because the turret tuner lends itself to such an arrangement, and it permits a television receiver to become a radio/television combination giving Band I and Band III television and all three B.B.C. V.H.F. sound programmes in Band II in a single instrument, at an additional cost of less than £5 in many cases. A single television aerial will pick up all the signals, and altogether it makes a very neat and tidy installation.

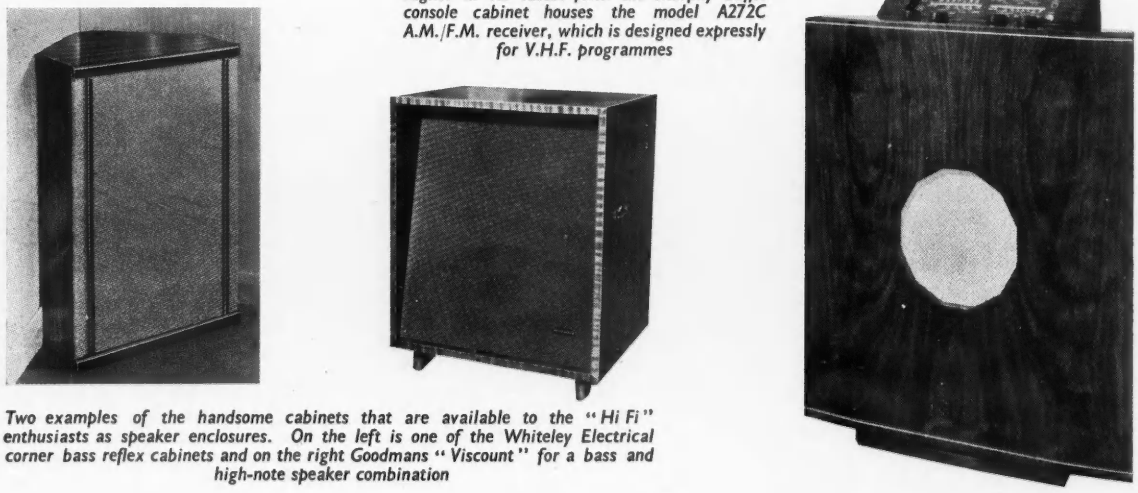


Examples of the variety of combined Band I/Band III television aerials are the Wolsey "In-line" assembly shown on the left and the J-Beam "Hornbeam" which combines a skeleton horn-cum-slot aerial of special design for Band III with telescopic adjustable Band I elements

The growing interest in improved musical reproduction associated with the better quality available from V.H.F. radio transmissions has led some manufacturers to include high quality audio amplifiers in their television receivers, and in some cases multiple loudspeaker combinations are employed. Television sound transmissions are often of a quality comparable to the best V.H.F. transmissions, but the sound channels in most television receivers suffer to some extent from the competitive price levels at which the instruments are sold.

In contrast to the constant demand for larger and still larger pictures, it is refreshing to witness what might prove to be a revival of the popularity of 9in and 12in cathode-ray tubes, for which there are now three receivers on the

Right: In its latest form the Murphy baffle console cabinet houses the model A272C A.M./F.M. receiver, which is designed expressly for V.H.F. programmes



Two examples of the handsome cabinets that are available to the "Hi Fi" enthusiasts as speaker enclosures. On the left is one of the Whiteley Electrical corner bass reflex cabinets and on the right Goodmans "Viscount" for a bass and high-note speaker combination

market. One of these is a conventional 12in receiver in a utility cabinet costing just over £50, and another is a 9in model designed deliberately as a "second" set, to be used in the bedroom or nursery for instance, like a midget radio.

The third is a fully transportable television receiver with a 9in tube and a telescopic aerial that can be used anywhere within range of a transmitter. It can be operated from the electricity mains or from a car battery, and a specific application for which it is intended is installation in a car. It can be used in the car while running, taken out and run from the car battery while it is stationary, and then by a simple plug and socket device it can be converted to a mains receiver and used in the house.

A great deal of development has taken place in the design of television aerials for permanent installations. With the general adoption of multi-channel tuning in receivers it has become necessary to design efficient multi-channel, or at least two-band, aerials, because the viewer wants the neatest and cheapest form of aerial on his roof, and most receivers have only a single aerial socket for the Band I and Band III feeder cable.

Single-channel television aerials have gone through a remarkable series of geometrical evolutions in the course of time, and the pattern is being repeated in a smaller degree in twin-channel designs. Combined aerials to work efficiently in Band I and Band III are not easy to design, and the difficulty is complicated by the variation in channel frequency ratios in different areas. In London, for instance, the frequency ratio between channel 9 and channel 1 is approximately 4 to 1, but in Birmingham it is about 3 to 1, and this affects the efficiency of a combination which uses a single feeder cable. As a result, the general pattern of aerials may be seen to be different in one area from that in another.

The I.T.A. has undoubtedly provided the viewer with a popular alternative programme, and its service is gradually being extended to new areas. Here for the initial period conversions will be the order of the day where old installations exist, both of aerials and receivers. Aerials will be converted by the addition of separate Band III aerials or by adaptor rods on the existing aerial, and single-band receivers will require a tuner unit. Numerous examples of aerials and tuners are exhibited at the Show, where this year for the first time the I.T.A. will be represented as well as the B.B.C.

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

THE progressive erection of long-distance e.h.v. lines and the fact that these require the introduction of grouped conductors renders reports on the characteristics of such lines already operating and the different solutions of the various design and other problems always interesting. The authors present a comprehensive description of German practice in this field, with special stress on conductor materials and insulator types used, and fittings (clamps, connectors and spacers). A section deals only with detailed descriptions of the specially developed types of pylons, their footings and foundations, earthing, earth-wire protection and description of pylon and conductor erection work in difficult sites. The article is profusely illustrated and well documented.—"Overhead Lines with Grouped Conductors," S. Hammel and H. Mors, *A.S.E. Bull.*, Vol. 47, No. 14, pp. 617-631, 7th July, 1956, in German.

Silicone Dielectrics

Heat resistance of electric insulation materials, whilst a condition *sine qua non* of their usefulness, is not in itself sufficient to render any material suitable for continuous service in electrical machines and apparatus. This applies particularly to the many different kinds of modern plastics, chemically speaking, organic polymers. What is required is, in addition to the thermal stability in the accepted sense of the term, the conservation of the elastic properties of the materials when kept for long periods at high temperatures. It is already known that silico-organic polymers possess this valuable characteristic, but more detailed investigations are necessary, to establish not only the facts, but also the criteria enabling the characteristics of new materials to be predicted.

A valuable contribution to this problem is presented in the paper, containing the explanation of the high thermo-elastic characteristics of silicone materials. Their high resistance to thermal oxidation and destruction is due to the high Si-O bond energy, which has also a screening effect on the silicon-radicals; furthermore, the stable siloxane bonds instead of oxidisable radicals in the polymer prevent disintegration of the macro-molecules. Particularly important is the formation of a protective layer saturated with siloxane bonds on the surface of the polymer during a thermal oxidation process, preventing a deeper penetration into the material. The optimum characteristics are possessed by polyorganic siloxanes containing methyl, vinyl and phenyl radicals. With a judicious choice of the constituents, the thermal elasticity of the product is directly proportional to the thermal stability, considering the degree of polarity and the adhesion resulting from it.—"Thermo-elasticity of Silicone Dielectrics," K. A. Andrianov and N. N. Sokolov, *Elektrichestvo*, No. 6, pp. 31-34, 1956, in Russian.

Welding Copper Cable Joints

Mere conductor splicing, though for long the preferred method of jointing cable conductors, is no longer satisfactory in the light of the more stringent conditions imposed where residual resistances, shockproofness and general mechanical and chemical durability of the joints are concerned. The choice is now between soldering and welding techniques. Soldering with propane tools is well known and satisfactory with copper conductors, but aluminium conductors require welding; this is also possible in a propane-oxygen flame. Now propane-soldering or welding are operations largely dependent on the operator's skill and by no means foolproof, since excessive, or interrupted, application of the heat results in the formation of Cu-Cu_2O eutetic in the joint, embrittling the latter and reducing its conducting section.

In a special investigation on soldered and welded joints

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

a handy portable electric joint-welding outfit supplied by a 6 V accumulator battery was developed, the carbon electrodes of which have disc shape and are at a spacing of only 0·1 mm, with a glass tissue layer interposed. Also, the carbon electrodes have appropriate funnel-shaped recesses on their faces and peripheries to accommodate the spliced conductor strands, the latter forming in this way conducting bridges between the electrodes. The tips of the conductor strands are therefore rapidly heated on the passage of current and the concentrated current density in the recessed funnels into which the spliced conductor ends are inserted, welds the latter firmly together. The usual welding beads are for this reason of conical shape.

The whole operation takes only 1 sec, and no Cu_2O is formed owing to oxygen-absorbing admixtures to the electrode material.—"A New Electric Welding Method for Copper Cable Jointing," W. Rücker and P. Raphael, *NTZ*, Vol. 9, No. 5, pp. 211-213, May, 1956, in German.

British Standards Institution

Wide Range of Activities Reviewed

STEADILY growing support from industry for the work of the British Standards Institution is reflected in the B.S.I.'s annual report for the year ended 31st March, 1956. The number of subscribing members—commercial firms, trade associations and professional bodies—reached the record figure of 8,650, over 4 per cent higher than in the previous year.

The first section of the report, which serves as a general introduction, includes references to the progress made in the study of fuel efficiency, the completion of the first British Standard concerned with smoke abatement, and preliminary steps taken in the preparation of standards required for the development of nuclear energy. It also describes conferences held during the year to stimulate interest in, and discussion of, standards techniques as an aid to productivity.

In relation to consumer goods the report records the completion of the labelling "quiz" conducted by the Advisory Council on Standards for Consumer Goods. The main body of the report contains a detailed review of the standards projects completed and in hand in the Institution's four main divisions: building, chemical, engineering and textiles (and in the industries outside the scope of these four), and the work carried out under the Council for Codes of Practice.

Important features of engineering activity were the preparation of glossaries of terms; a wide range of work on aircraft standards; a large and varied national and international programme of electrical work; a review of specifications for non-ferrous metals; and progress with the preparation of summary sheets.

Record Sales

A page of statistics records that there were nearly 4,000 meetings of technical committees whose work resulted in the publication of more than 200 new standards. New and revised standards issued during the year affect almost every aspect of industrial production from steel plate to school furniture, from electric blankets to aluminium ingots, from shoe laces to scalpels. Sales of British Standards reached a new record level of 934,000, a quarter of these being sold abroad.

The international section of the report contains an account of the B.S.I.'s increasing contribution to the work of many of the 83 committees of the International Organisation for Standardisation (I.S.O.) and the 42 committees of the International Electrotechnical Commission (I.E.C.) which were active during the year. Here undertakings of particular interest were discussions on medical gas cylinders, the revision and extension of the well-known classification of insulating materials, work on tests for chemicals, discussions on unification of screw threads, recommendations on ball and roller bearings, and proposals for common names for pest control chemicals.

Other aspects of international co-operation on standardisation included a conference of the ABC countries (America, Britain and Canada) to secure closer unification of basic engineering standards, the B.S.I.'s participation in the work of the European Productivity Agency (which is studying and encouraging methods of simplifying production in various countries), and preparations for next year's Commonwealth Standards Conference in Delhi.

This heavy programme of international work is evidence of the importance the Institution attaches to the export aspects of its work, in which, as the report shows, it has been encouraged by its own export panel.

Revised Standards

Electric Fires.—Among the recent publications of the British Standards Institution is a revision of B.S. 1670, "Safety Requirements for Electric Fires." This revision has been made with the object of ensuring that the requirements for the fireguards are in line with B.S. 1945:1953, "Fireguards for Heating Appliances," and with Supplement No. 1 (1956) to B.S. 1945.

The clauses originally included in B.S. 1670:1951 dealing with the guard are now omitted and cross reference is made to B.S. 1945. To make the revision to B.S. 1670 a self-contained document an appendix has been added which includes the clauses of B.S. 1945 covering the requirements for the guards of electric fires. The revision also incorporates a number of minor amendments to facilitate interpretation of the standard. No important alterations of a technical nature have been included in the revision. Copies of the standard may be obtained from the Institution, 2, Park Street, London, W.1, price 3s 6d.

Mining Cables.—Wire-armoured paper-insulated cables for use in mines are dealt with in B.S. 760:1956 (price 5s) which is a revision of the original document published in 1943. It follows closely on the lines of B.S. 480:1954 but is designed to meet the special conditions of mining practice. The specified thicknesses of insulation are greater than those required by B.S. 480 and no provision is made for aluminium sheaths or tape armour. All cables made to B.S. 760 are now required to be of the non-draining type and the range has been extended to include 11 kV screened cables. Alternative water-resisting and fire-resisting finishes are specified and a fire resistance test is included. Like other recently revised British Standards for electric cables, B.S. 760 now contains clauses defining the composition and quality of the components.

Automobile Filament Lamps.—The latest edition of the 15-year-old B.S. 941 dealing with automobile filament lamps covers a more comprehensive range of lamps used in present-day motor vehicles, including commercial goods vehicles, and has been extended to include 24 V lamps. A set of ten schedules giving the main dimensions, cap designation, initial readings and life performance for the complete range of lamps used with 6 V, 12 V and 24 V electrical equipment has been added, but lamps with British pre-focus caps are not included.

The specification is divided into four sections. The first general section in addition to giving definitions and general requirements includes a clause on market selection. The remaining sections deal, as before, with the selection of lamps for test, conditions of test and rejection. The price of the new standard is 7s 6d.

Western Germany's Progress

Increased Production and Exports

By R. E. KAAN, Dipl.Ing.

EXPANDED production and trade, full employment, and well-spread order books to an extent which even the most optimistic economic forecasts did not anticipate, all contributed to Western Germany's remarkable export achievements during last year.

Further growth of Western German industry and its competitive power will largely depend on the outcome of outstanding wage disputes, and endeavours to secure shorter working hours; future armament commitments; relief from skilled labour shortage and lack of designers; the adequate supply of certain raw materials and semi-finished products; and the maintenance of steady price levels at home and abroad.

Western Germany's future economic outlook, though still very confident, is perhaps not quite so bright as in the recent past. Undoubtedly, inflationary tendencies at home, increased competition not only overseas but in the home market, drastic fiscal and monetary measures introduced recently, have all contributed to dampen the otherwise high spirits prevailing at the Hanover Fair, which seems to have been another outstanding success. Out of a total number of 3,947 stands (3,820 last year) the biggest contingent represented the Western German electrical industry, namely, 948 against 885 last year. The United Kingdom's electrical industry contributed twelve stands. This year's electrical fair was noteworthy for the inclusion of 380 kV switchgear, automation and other applications of electronics, including transistor techniques, and "miniaturisation" of components.

The significance of Western Germany's economic upswing during the past year is shown in Tables 1 and 2.

TABLE 1.—WESTERN GERMANY'S ELECTRICAL TRADE, 1953/56

Year	Imports		Exports	
	Weight (hundred kg)	Value (£ million)	Weight (hundred kg)	Value (£ million)
1953	106,238	8·8	1,706,317	105
1954	138,547	13·6	2,380,162	141
1955	187,560	17·3	2,763,140	175
Jan.–Mar., 1956	46,159(+3%)	4·1(+4%)	708,374(+16%)	49(+23%)

TABLE 2.—ANALYSIS OF WESTERN GERMANY'S ELECTRICAL TRADE, 1954/55

Class	EXPORTS				IMPORTS			
	1955		1954		1955		1954	
	Weight Hundred kg	Value £000	Weight Hundred kg	Value £000	Weight Hundred kg	Value £000	Weight Hundred kg	Value £000
Complete power stations	171,264	6,825	90,084	5,852	9,091	572	Not available	
Steam engines and turbines without boilers	15,198	1,676	19,474	1,923	8,056	341	7,160	465
Water wheels and turbines	55,376	2,987	62,533	2,814	1,561	53	2,298	10
Gas engines and turbines	3,303	221	2,751	196	135	14	82	108
Motors and generators—								
Up to 10 kW	74,059	4,432	57,665	3,450	10,279	580	6,326	333
10–1,000 kW	91,514	4,542	66,310	3,419	19,076	811	11,020	501
Above 1,000 kW	52,835	2,375	54,468	2,587	516	27	420	18
Rotary convertors	10,096	622	8,876	493	4,669	292	1,080	83
Generating sets, incl. turbo-alternators	105,083	6,657	132,520	7,825	1,941	100	1,269	96
Transformers and chokes	102,889	4,063	105,336	4,524	6,497	362	2,278	180
Rectifiers	9,318	1,537	6,478	1,142	430	83	702	86
Parts of electric generators, motors and rotary convertors, transformers and rectifiers	42,443	2,657	34,874	2,032	9,033	292	7,282	721
Electro-magnetic apparatus	5,283	645	3,707	472	1,879	143	687	59
Primary elements	20,500	525	32,470	761	856	61	593	39
Accumulators, complete	75,631	2,093	66,726	1,826	1,104	39	335	19
Accumulators, casings	35,799	545	29,671	502	245	23	52	3
Electric tools	14,688	2,763	18,205	2,365	705	190	376	105
Vacuum cleaners and floor polishers	16,644	1,907	18,265	1,463	1,407	182	1,499	158
Washing, drying and wringing machines	84,324	4,232	60,639	3,062	16,679	815	6,079	295
Fans	3,841	417	2,608	287	333	36	134	17
Electro-magnetic household app. up to 15 kg	5,778	705	3,963	442	909	106	454	656
Hair clippers and dry shavers	1,095	162	1,417	816	1,602	682	1,488	632
Ignition app. for combustion engines	20,204	2,483	14,452	1,763	1,630	275	811	152
Elec. equipment for vehicles	67,501	6,372	60,052	5,872	1,618	172	1,535	178
Welding apparatus	22,064	1,822	21,591	1,679	6,483	550	3,678	324
Industrial furnaces and parts	31,705	1,622	31,152	1,462	1,754	135	2,389	162
Industrial and household cookers	42,614	1,827	29,754	1,261	563	36	320	27
Flat irons	22,690	926	19,968	763	44	5	79	9
Heating appliances and parts	32,950	2,863	23,526	2,132	1,584	165	1,429	126
Arc lamps	564	46	303	39	132	21	90	15
Portable flashlights	2,205	312	2,694	323	70	16	196	29
X-ray equipment	15,408	3,911	13,376	3,439	640	225	514	235
Electro-medical apparatus	4,902	1,562	4,523	1,342	591	161	482	105
Telephone apparatus	26,463	7,510	21,536	5,153	236	68	267	81
Telegraph apparatus	3,469	1,931	2,493	1,452	113	48	166	107
Microphones, amplifiers and loudspeakers	3,929	714	2,285	502	1,453	301	1,008	176
Hearing aids	71	131	17	79	74	132	19	71
Wireless transmitting and receiving equipment	167,235	24,311	104,148	15,136	5,015	1,461	3,630	1,157
Scientific instruments	1,423	711	1,818	641	430	48	63	48
Signalling control apparatus	1,098	588	4,877	543	278	74	226	49
Resistances and regulators	13,207	2,901	12,519	2,261	3,696	1,072	2,168	601
Condensers and capacitors	8,290	1,567	5,681	1,211	1,875	414	1,279	282
Switchgear and switchboards	83,947	8,024	75,602	7,523	3,568	605	3,594	502
Installation material up to 750 V	75,869	5,812	62,281	4,351	1,649	356	1,120	235
Cables	443,735	10,914	365,525	7,732	1,924	46	2,149	43
Insulated wires and flexes	157,015	5,872	247,352	7,465	3,031	188	1,134	85
Electrodes and carbons for electrolysis	152,836	1,952	131,744	1,634	37,916	242	32,531	192
Carbon products	16,670	1,166	15,508	1,097	1,712	183	999	102
Insulators	28,596	691	24,761	673	763	51	428	41
Insulating material	22,390	781	17,321	601	219	39	206	26
Insulating tubing	20,271	242	28,073	235	34	3	114	7
Tungsten lamps	9,985	1,510	7,328	1,231	2,162	252	2,059	265
Fluorescent and neon lighting	2,621	157	2,374	143	5,015	343	3,413	266
Electronic and cathode ray tubes	5,484	2,601	4,228	1,736	5,281	1,653	4,104	1,352

It will be noted that not only did Western Germany's electrical exports increase considerably between 1954 and last year (+24 per cent) but her imports (+28 per cent) also rose, with a few exceptions. Outstanding import increases included motors, domestic appliances and electronics.

The latest export figures, those for the first quarter of this year, compared with the same period in 1955, again show an upward trend of 16 per cent in volume, and 23 per cent in value.

The figures of electrical trade between the United Kingdom and Western Germany listed in Table 3, show the steep increase of exports in favour of Western Germany, while Table 4 shows the still latent openings for United Kingdom manufacturers, particularly those concerned with domestic appliances and electronics.

Table 5 reveals two most interesting facts: first, the loss of ground in Argentina, Brazil and Uruguay and Russia, and secondly, the further gain of the Western German electrical industry in certain Commonwealth countries, the Middle East, and in Europe (see also Table 6).

The export outlook for the United Kingdom manufacturer to Western Germany is at present undoubtedly better than ever before, the reasons being the proposed reduction of import duties in order to check rising home prices and the unsatisfied demand especially in domestic appliances.

TABLE 3.—ANGLO-GERMAN ELECTRICAL TRADE (£ million)

Year	U.K. exports to Western Germany	Western German exports to U.K.
1953	0·8	1·3
1954	1·6	2·4
1955	2·4	5·9

TABLE 4.—UNITED KINGDOM EXPORTS TO WESTERN GERMANY, 1955 SELECTED PRODUCTS

Class	Value (£000)
Generating plant	206
Motors	16
Control gear	39
Transformers	23
Switchgear	3
Welding plant	13
Heating, cooking and domestic appliances	998
Refrigerators	331
Instruments and meters	98
X-ray and medical appliances	27
Radio and electronics	848

TABLE 5.—PRINCIPAL DESTINATIONS OF WESTERN GERMAN ELECTRICAL EXPORTS (£ million)

Country	1954	1955
United Kingdom	2·4	5·9
Austria	5·3	8·3
Belgium-Luxembourg	9·2	10·6
Denmark	2·8	2·9
Finland	2·9	3·9
France	4·1	4·5
Greece	2·3	2·5
Italy	9·2	10·5
Jugoslavia	2·7	4·2
Netherlands	13·4	18·8
Norway	5·2	5·9
Portugal	1·5	2·9
Sweden	11·2	14·2
Switzerland	7·2	9·0
Spain	1·5	2·1
Turkey	2·7	5·2
Russia	3·2	0·1
Hungary	3·7	4·7
Egypt	2·5	2·7
Kenya and Uganda	0·1	0·3
South Africa	1·0	1·6
Indonesia	1·4	1·7
Iraq	0·4	1·0
Iran	1·8	2·1
Israel	1·1	2·3
India	2·5	4·4
Pakistan	1·9	2·9
Malaya and Singapore	0·5	0·7
United States	2·1	3·9
Canada	0·4	0·6
Mexico	0·7	1·0
Argentina	5·8	3·9
Brazil	5·0	2·9
Chile	0·8	1·1
Colombia	2·1	2·8
Uruguay	2·1	0·8
Venezuela	4·3	4·8
Australia	1·6	1·5
New Zealand	0·2	0·3

TABLE 6.—DISTRIBUTION OF WESTERN GERMAN ELECTRICAL EXPORTS (Percentages)

Continent	1953	1954	1955
Europe	66·0	63·5	66·5
Africa	5·1	4·7	3·9
Asia	9·9	12·3	13·5
N. & S. America	18·5	19·4	16·0
Australia	0·5	0·1	0·1

Opportunities in Guatemala

THE market for electrical goods in Guatemala is not a large one at present (British imports in 1955 were valued at £27,383), but the standard of living in the country is rising and the market should offer many opportunities in the future for United Kingdom exporters and investors. This is stated by Mr. P. J. E. Male, First Secretary (Commercial) and Consul at H.M. Legation, Guatemala City, in his survey of the economic and commercial conditions in Guatemala (H.M. Stationery Office, 1s 6d, by post 1s 8d).

Mr. Male says that there is room for expansion in the electrical machinery and equipment field. In the public sector the Government has plans to treble existing generating capacity over the next five years, the National Council of Economic Planning, set up in 1954, including in its programme for the period 1955 to 1960 a plan for increasing the present generating capacity of 40,000 kW to 116,800 kW by means of a number of hydro-electric projects; the largest of these is for a 50,000 kW station.

In the private sector, at present British diesel generating sets have a good share of the market. There is every reason to suppose that demand for small generating sets for use in the provinces will continue at a constant level.

Holland, Germany and the United States are ahead of the United Kingdom in the supply of radio receivers. The United States is virtually alone in supplying television equipment, the local service having very recently started. There is no apparent reason why British products could not do much better. The lower the price the better for general sales, but there are also customers for luxury equipment. In all ranges a "flashy" appearance is acceptable. The Government is turning its attention to improving telephone systems and has plans for microwave links between regions.

Fenchurch Street–Southend Electrification

WORK has now begun on the rearrangement of the rail approaches at Barking, an essential part of the Eastern Region electrification of the 77 miles of route between Fenchurch Street, Tilbury and Southend-on-Sea (Central). This complex railway engineering scheme, which will cost £1,750,000, is one of the most important works in the electrification of the line announced under British Railways £1,200 million modernisation and re-equipment plan.

The work to be carried out involves the construction of a new double-track bridge over the River Roding and a main fly-over west of the station to carry traffic to and from Woodgrange Park over the main Fenchurch Street—Southend and London Transport District lines. A second fly-over west of the station will carry the westbound London Transport District line over the Fenchurch Street—Southend lines and a burrowing junction east of the station will enable westbound London Transport trains to pass under the Fenchurch Street—Southend line. Barking station buildings both on street level and on the platforms are to be reconstructed, the station lighting being converted from gas to electricity. There will also be complete re-signalling, including the construction of a new signal box.

Cellular Polythene

Its Use as a Dielectric Material in the Cable Industry

By J. MOSS, B.Sc.*

As will be seen in the accompanying photograph (Fig. 1) cellular polythene consists of a system of small non-connected gas cells distributed throughout polythene. The material, as would be expected from the construction, has a permittivity intermediate between that of the gas and of polythene, and in practice permittivities between 1·4 and 2·3 can be obtained by controlling the ratio of polythene to gas. Add to this the low electrical loss properties of the material and its resistance to moisture absorption and it becomes apparent that the cable designer has a versatile new material at his disposal.

In cable applications where it is necessary to convey signals from an aerial to a receiver with a minimum of attenuation, as for instance in the reception of Band III television signals, it is not surprising that cellular polythene is chosen as the dielectric for the cable in preference to solid polythene, since it is possible to design low attenuation cables of smaller physical size than would be possible with solid polythene. Consequently, a range of cellular polythene coaxial television downlead cables is now available for fringe and service area reception in Bands I, II and III. It is confidently expected that these cables will be as satisfactory in service as the long-established solid polythene types.

Fig. 1.—Cross-section of cellular polythene for television downlead cable

Manufacturing Process

Before processing into the cellular state polythene is first compounded to produce an intimate mixture of polythene, finely divided blowing agent, and antioxidant, the compounded material then being diced for use in conventional extruders. The blowing agent is a chemical which when heated above its decomposition temperature liberates copious supplies of gas, generally leaving behind a very small residue of solid material. All compounding is therefore carried out below the decomposition temperature of the blowing agent. The percentage of blowing agent added to the polythene is controlled so that after decomposition the final cellular structure will have gas and polythene in the correct proportions to give the desired permittivity.

The diced compounded material is fed to the hopper of an extruder whose temperature is carefully controlled along the barrel and head so that the blowing agent decomposes at the head end of the barrel. Heavy sieve packs are used in the extruder so that back pressure is high and the gas is retained in a compressed state in the molten polythene.

Correct temperature at each point is essential for satisfactory extrusion. If temperatures are too high gas tends to diffuse too readily through the polythene and the resultant product is too dense and has a rough surface finish. If temperatures are too low insufficient decomposition of the blowing agent occurs and density of the product is again too high.

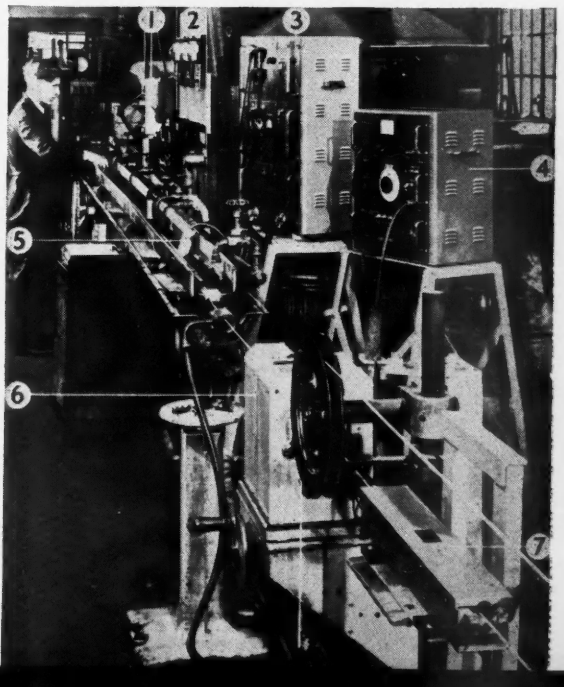
The polythene emerges from the extruder through a die whose aperture is calculated to give the correct final diameter of the dielectric, bearing in mind that expansion takes place after the polythene leaves the die. The percentage of blowing agent in the compound, extruder output characteristics, extruder temperatures, die aperture size, and haul-off speed fix the diameter of the cable. Water cooling has been found to be effective with cable of permittivity as low as 1·4 and an outside diameter of 0·3in, but for cables of lower permittivity or greater diameters water cooling causes collapse of the cell structure and flattening of the cable. Air cooling must then be used if satisfactory shaped cable is to be manufactured.

From this brief description the reader may conclude that cellular polythene is more difficult to deal with than ordinary polythene. Fundamentally this is true, but by rigorous attention to detail at all stages of manufacture and by the use of specialised control equipment cable of uniform quality and expected characteristics can be made as a routine factory process.

Control of Electrical Characteristics

In a process where there are a number of independent variables, each influencing the final product, it is almost essential to employ equipment which will continuously monitor the cable quality. An instrument has accordingly been developed which measures the capacity of the cable continuously in pF/ft, and this capacity monitor is now in regular use during cellular polythene extrusion. Providing the capacity and dimensions of the cable are correct then the remaining electrical characteristics will be

Fig. 2.—Extruder for precision extrusion of cellular polythene cables. (1) Eccentricity signal display unit. (2) Electronic pyrometer control panel. (3) Eccentricity gauge control unit. (4) Capacity monitor control unit. (5) Capacity monitor signal receiving unit. (6) Eccentricity gauge signal receiving unit. (7) Eccentricity gauge signal input unit



* British Insulated Callender's Cables, Ltd.

Cable Type	Inner Conductor P.C.W., in	Diameter, inches			Electrical Characteristics						Notes
		Dielectric	Screen P.C.W.	Sheath P.V.C.	Capacity pF/ft	Impedance Zo ohms	Attenuation dB/100ft 50 Mc/s	200 Mc/s	Permittivity K 100 kc/s to 200 Mc/s	Loss Angle tan δ 100 kc/s to 200 Mc/s	
Cellular Polythene T.V. Downlead	1/0·022	0·093	0·117	0·157	16·5	75	3·0	6·3	1·45	0·0005	Band I Service Area Cable
Solid Polythene T.V. Downlead	1/0·022	0·128	0·152	0·202	20·0	71	3·0	6·0	2·3	0·0003	Band I Service Area Cable
Cellular Polythene T.V. Downlead	1/0·029	0·128	0·152	0·202	16·5	75	2·3	4·9	1·45	0·0005	Bands I and III Service Area Cable
Semi Air-spaced T.V. Downlead	1/0·048	0·200	0·235	0·290	17	75	1·55	3·0	1·42	0·0001	Fringe Area Cable for recept. in Bands I and III
Cellular Polythene T.V. Downlead	1/0·044	0·200	0·235	0·290	16·5	75	1·5	3·0	1·45	0·0005	Fringe Area Cable for recept. in Bands I and III

Characteristics of T.V. downlead cables of cellular polythene construction with alternative construction T.V. downlead cables for comparison purposes.

satisfactory. A continuous watch is also kept on the position of the wire in the dielectric by means of an eccentricity gauge, which will show deviations of the wire from centre of as little as 0·0003in. A typical extrusion line incorporating the continuous monitoring devices is shown in Fig. 2.

Physical and Electrical Characteristics

In addition to the continuous checks provided by the equipment described above it is standard practice to sample the production regularly at all stages of manufacture, so that considerable information on both the electrical and physical properties of cellular polythene is now available.

The accompanying table indicates the electrical properties of three standard cellular polythene television downleads produced at the Helsby factory of B.I.C.C., Ltd., with, for comparison purposes, those of two television downleads of similar characteristics but different construction. Manufacturing experience with several million yards of cellular cable has shown that the nominal characteristics are quite closely met in practice. As one example, statistical analysis of impedance data for one cable gives an impedance of 74·8 ohms $\pm$ 2·8 ohms.

It will be noted that the loss angle of cellular polythene at 0·0005 is slightly greater than that of solid polythene (0·0003) due to the residue left by the blowing agent, but it will be appreciated that at the television frequencies the dielectric loss is of minor importance. For example, at 200 Mc/s the dielectric loss of the 0·200in cellular cable in the table accounts for only 5 per cent of the total attenuation.

Extensive long-term ageing tests have been carried out and as an example illustrating the stability of cellular polythene it can be quoted that after 2,500 hr at 140 deg F there was no change in the permittivity of the dielectric at 1 kc/s and 200 Mc/s. Cellular polythene has resistance to water absorption of the same order as solid polythene and tests have shown that after immersion in water for several months the insulation resistance of cellular polythene is still greater than 10^{16} ohm/cm, which is equivalent to 24,300 megohm per 1,000 yd for the 0·200in cellular cable.

Electrical testing has also shown that the cables have satisfactory uniformity of electrical characteristics with frequencies in the range 0-200 Mc/s so that selective attenuation of any signal in the television frequency range is not to be expected. The dielectric strength of the material, although only about one-third of polythene, as would be expected, is 150-250 V/mil which is more than adequate for the downlead field.

Mechanically, cellular polythene is not as strong as solid polythene, as would be anticipated from the structure of the material. The tensile strength and elongation at break are about one-third to one-half of those of solid polythene but the mechanical strength is still fully adequate for coaxial cable use.

Television downleads provided an obvious application for cellular polythene as a dielectric since the material possesses all the advantages associated with semi-air-spaced cables of conventional types whilst the closed cells give increased resistance to water ingress. It is felt, however, that the television downlead application is only one of a multitude of possible applications, and its potential use in telephone cables opens interesting new vistas to the designer and development engineer alike. It is difficult to forecast the future but it may be that in time cellular polythene will play as important a part in the cable industry as dry core paper has to date. Much work remains to be done, for instance, in refining techniques of extrusion and obtaining blowing agents which will decompose to give finer gas cells whilst leaving no residue, but the challenge is obvious and it is to be expected that one by one the problems will be overcome and this new material will extend into ever wider fields of usefulness to the electrical engineer.

I.E.E. Publications

THE Institution of Electrical Engineers has announced its intention to publish during the coming autumn various supplements to the I.E.E. *Proceedings*.

In December there will be published a supplement to Part A, which will contain a complete report of the convention on "Electrical Equipment of Aircraft" which was held from 2nd to 4th March last; the price will be £1 10s.

There will be three supplements to Part B which will report in full the convention on "Digital-Computer Techniques" held from 9th to 14th May last:—Supplement 1 will cover sessions G1 to G4 and S1 to S3 and will be published in September; Supplement 2 will cover sessions G5 to G7 and S4 and S5, and will be published in October; and Supplement 3 will cover sessions G8 to G10 and S6 and S7, and will be published in November. These three supplements will be available at £2 15s complete or at £1 each. Orders should be sent to the Secretary, I.E.E., Savoy Place, London, W.C.2, with remittances as soon as possible.

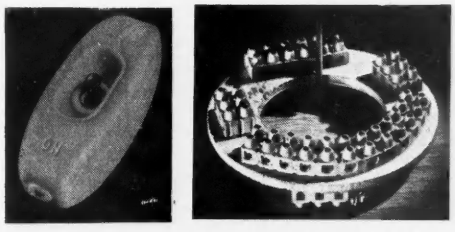
NEW ELECTRICAL EQUIPMENT

Cord Switch

A new cord switch specifically designed by the WARM-GLOW CO., LTD., Progress Road, Leigh-on-Sea, Essex, for use with its single-heat electric blankets has been announced. It is a two-pole toggle type switch rated at 250 V, 1 A, a.c. or d.c., with self-cleaning contacts. There are no exposed metal parts, the case, recessed dolly and bush being fully insulated. It measures 3½in long by 1½in wide by $1\frac{5}{16}$in deep and weighs less than 2 oz. For night indication the switch can be provided with a neon lamp which glows when "on." The price, with solder tags, in ivory white is 7s 8d. Models with screw terminals are 8s. Neon indicator models are 2s 4d extra (4s 8d for two neon indicators).

Flexible Terminal Block

A new 12-way terminal block in flexible p.v.c. is available from BELLING & LEE, LTD., Cambridge Arterial Road, Enfield, Middlesex, for an almost unlimited range of applications.



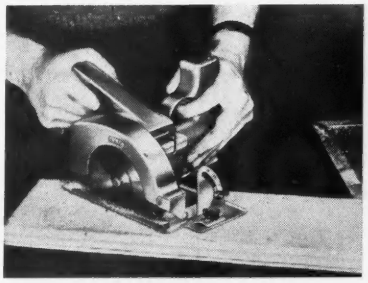
Left: Warm-Glow blanket cord switch and (right) flexible 12-way terminal block

These blocks can be secured to irregular or radiused surfaces without risk of fracture and they are proof against breakage by vibration and mechanical shock. The terminal screws are gripped securely by the resilient moulding and cannot fall or be shaken out even when the block is mounted upside down.

Fixing holes are provided between each pair of terminals and sub-division with a knife is possible, particularly as the material does not splinter when cut. Oil and acid resistant, the new terminal blocks are available in two sizes rated at 5A/250V and 15A/500V respectively.

Portable Saw Attachment

A portable saw attachment has now been added to the range of "Cub" home handyman portable tools made by WOLF ELECTRIC TOOLS, LTD., Hanger Lane, London, W.5. An exclusive feature of this attachment (which is fitted with a 5in diameter rip and cross-cut blade) is that, apart from being suitable for making straight and bevel cuts of up to 45 deg, the blade can be adjusted by means of two pairs of tapered washers so that grooves of up to ⅜in in width can be made. A spring-loaded telescopic guard is permanently fixed into position on the attachment, thus ensuring perfect safety to the operator under all working conditions.



Wolf "Cub" portable saw attachment in use

The attachment consists of two light alloy castings, the shape of which form a cradle for the Wolf "Cub" power unit, thus holding it securely in position. A pressed steel soleplate is fitted which is adjustable by means of wing nuts for either depth or bevel cutting. A pressed steel rip fence is also incorporated in the soleplate assembly so that accurate cuts may be made without the use of scriber or pencil guide lines. The retail price of the attachment is £3 19s 6d.

Flameproof Energy Regulator

The Type FER/1 energy regulator introduced by ISOPAD, LTD., 30-32, Rosemont Road, London, N.W.3, is similar to the existing Type ER but is housed in a flameproof case. The regulator has a maximum loading of 1·5 kW and operates on the proportional time principle. This form of operation is simple, since it involves merely a positive on-off control of the energy source, yet gives a very close control of power and therefore of the temperature of the heated plant or equipment.

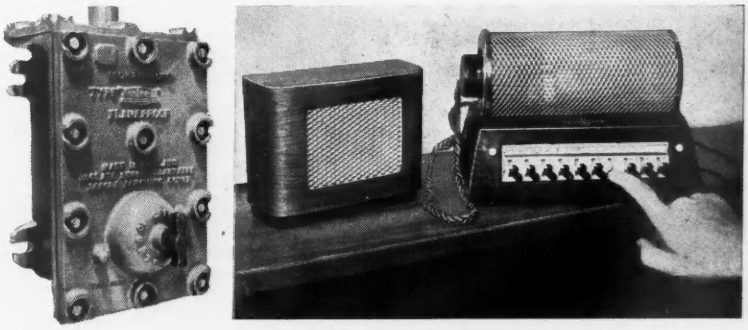
The standard casing of the new regulator is 11½ by 6⅜ by 4¾in and has two ¾in conduit entries. Four robust fixing lugs are provided. The control knob turns over a dial with integrally cast calibrations, so that any desired setting within the range can be selected.

If required, a casing with a neon indicator lamp can also be supplied. The FER/1 energy regulator is designed to control a single circuit. Similar units comprising regulators for two or more circuits are available to control larger installations or single heaters with several circuits arranged to achieve the required temperature gradient.

Intercommunication System

A new intercommunication system, similar in appearance to the instrument used in the company's "Soundmaster" system, is announced by COMMUNICATION SYSTEMS, LTD., Strowger House, 8, Arundel Street, London, W.C.2. It has a highly sensitive microphone housed in a circular grille and is designed to give good quality reproduction even when spoken into from some distance. The improved performance has been achieved by new circuitry and, by keeping the loudspeaker entirely separate from the microphone and keying unit, the risk of feed-back has been entirely eliminated.

Master station calls take priority over those from all substations and connection can be obtained instantly by pressing the appropriate key. The lifting of a hand receiver at the side of the microphone unit automatically disconnects the loudspeaker when privacy is required. Normal lamp and buzzer signalling are provided, but when it is necessary to avoid interruptions the buzzer can be silenced. The ten, fifteen and twenty line substations used in the system are of the dual wall/desk pattern.



Left: Isopad flameproof energy regulator and (right) Communication Systems intercommunication master station unit with its associated loudspeaker

DOMESTIC ELECTRICAL EQUIPMENT

Blankets and Pads

As will be seen from the following survey the firms engaged in the manufacture of electrically heated blankets and pads number almost as many as those producing electric fires or lighting fittings. This alone is an indication of the growing popularity of the electric blanket and, according to one manufacturer's literature, over 330,000 were sold in this country in 1955 compared with 90,000 in 1950. It is anticipated that this year the sales may well exceed the half-million mark.

In comparison with the hot water bottle, which can only warm a small portion of a bed at one time, the electric blanket commends itself in many ways with its constant and steady heat which can be maintained for an indefinite period, and in cases of sickness their value cannot be over-emphasised.

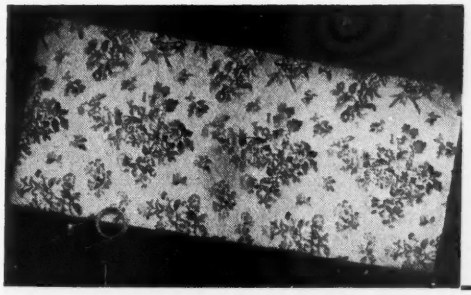
Running costs are negligible, owing to their low current consumption, and even the largest models cost little more than a penny for all-night use. Basically, there are two types, the slow heating blanket, fitted with self-compensating elements, and the faster heating thermostatically controlled models. In addition, there are low-voltage types suitable for operation through a step-down transformer.

Revised British Standard

Recently, the British Standards Institution has issued a revised edition of its year-old B.S. 2612 which is chiefly concerned with the strengthening of safety regulations. New inflammability tests have been included and a further modification is designed to minimise the possibility of blankets causing radio interference. Several manufacturers have submitted blankets to comply with the revised standard (B.S. 2612: 1956) and Isopad, Ltd., claim to be the first to have received their licence entitling them to carry the " Kite-mark " of approval on their products.

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
H. J. BALDWIN & CO., LTD., 132, Arkwright Street, Nottingham.	" Thermat " Pad	16×12	50 W	Three-heat, thermostatic	Various floral designs	Wool	—	£4 0 0	£0 17 4
	" Thermat " Junior	40×26	50 W	Single-heat, non-thermostatic	White, pink, blue and floral designs	Wool	De-luxe models have quilted floral sateen covers	£4 9 0 £5 12 3 (de-luxe)	£0 19 3 £1 4 4 (de-luxe)
	" Thermat " Medium	60×26	75 W	Single-heat, non-thermostatic	White, pink, blue and floral designs	Wool	De-luxe models have quilted floral sateen covers	£5 18 0 £7 12 0 (de-luxe)	£1 5 7 £1 12 11 (de-luxe)
	" Thermat " Large	60×48	135 W	Single-heat, non-thermostatic	White, pink, blue and floral designs	Wool	De-luxe models have quilted floral sateen covers	£10 16 0 £12 12 8 (de-luxe)	£2 6 9 £2 14 9 (de-luxe)
BEST PRODUCTS, LTD., Felix Works, Felixstowe, Suffolk.	" Best " Blanket	60×30	90 W	Self-compensating element	Apricot	Duplex rayon	One-piece element, di-pole switch	£6 11 0	£1 8 9
	" Best " mattress overlay	66×30	100 W	Self-compensating element	Maroon figured	Cotton damask	One-piece element, di-pole switch	£5 14 6	£1 5 2
BESTFREND ELECTRICAL CO., LTD., Diceland Works, Banstead, Surrey.	" Luxecon " single	60×30	78 W	D/P neon illuminated switch	Various pastel shades	Raised cotton	Fireproof	£3 15 0	£0 16 5
	" Luxecon " double	60×50	130 W	D/P neon illuminated switch	Various pastel shades	Raised cotton	Fireproof	£5 19 6	£1 6 2
BULPITT & SONS, LTD., St. George's Works, 132, Icknield Street, Birmingham, 18.	" 812A "	60×30	90 W	Thermal balance	Deep pink	Flannelette	Washable outer covers available at 25/- extra	£6 10 0	£1 8 6
	" 814A "	60×50	150 W	Thermal balance	Deep pink	Flannelette	Washable outer covers available at 39/- extra	£9 0 0	£1 19 6
	" 809A "	16×12	40 W	Thermostatic	Deep pink	Flannelette	Price includes waterproof cover	£2 19 11	£0 13 1
	" 810A "	16×12	70 W	Three-heat switch and thermostat	Deep pink	Flannelette	Price includes waterproof cover	£3 2 7	£0 15 11

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
CHALFONT ELECTRICAL PRODUCTS LTD., Tyrrell Street, Leicester.	"Junior" single	48×26	60 W	Self-compensating element, single-heat switch	Pink, peach, blue and green	Cotton	Satin ribbon binding	£2 15 6	£0 12 0
	"Junior" double	48×30	90 W	Self-compensating element, single-heat switch	Pink, peach, blue and green	Cotton	Satin ribbon binding	£3 12 0	£0 15 7
	"Warmster" single	60×24	70 W	Self-compensating element, single-heat switch	Pink, peach, blue and green	Cotton/rayon	Very soft, satin ribbon binding	£4 0 0	£0 17 4
	"Warmster" double	60×42	130 W	Self-compensating element, single-heat switch	Pink, peach, blue and green	Cotton/rayon	Very soft, satin ribbon binding	£6 0 0	£1 6 0
	"De-Luxe" single	60×33	140 W	Thermostatic, three-heat switches	Pink, peach, blue and green	Wool	Satin ribbon binding	£8 15 0	£1 18 5
	"De-Luxe" double	60×51	220 W	Thermostatic, three-heat switches	Pink, peach, blue and green	Wool	Dual control, satin ribbon binding	£14 8 8	£3 3 4
	"Chalfont" single bed sheet	60×33	85 W (*a*) and 140 W (*b*)	Thermostatic, single-heat (*a*) and three-heat switch (*b*)	Pink, peach, blue and green	Rayon	—	£6 17 6 (*a*) £7 10 0 (*b*)	£1 10 2 (*a*) £1 12 11 (*b*)
	"Chalfont" double bed sheet	60×51	220 W	Thermostatic, three-heat switch	Pink, peach, blue and green	Rayon	Dual control	£12 16 0	£2 16 2
DENHAMS (NORWICH), LTD., All Saints Road, Acton, W.3.	"Norvic" pad P.1 and P.3	[illegible]	45 W (*a*) and 70 W (*b*)	Thermostatic, single-heat (*a*) and three-heat (*b*)	White, pink, blue and green	Cotton base, flannelette	Rayon covers	£2 13 2 (*a*) £3 10 11 (*b*)	£0 11 10 (*a*) £0 15 7 (*b*)
	"Norvic" single S.1 and S.3	30×54	95 W (*a*) and 110 W (*b*)	Thermostatic, single-heat (*a*) and three-heat (*b*)	White, pink, blue and green	Cotton base, flannelette	Rayon covers	£5 17 6 (*a*) £7 2 0 (*b*)	£1 5 9 (*a*) £1 11 3 (*b*)
	"Norvic" double D.R.3	45×60	150 W	Thermostatic, three-heat switch	White	Cotton base, wool	Detachable cover	£10 12 9	£2 6 9
	"Norvic" double dual-control D.S.3	56×60	195 W	Thermostatic, two switches	White	Cotton base, wool	Detachable cover	£14 4 0	£3 2 6
	"Norvic" single W.1 and W.3	30×54	95 W (*a*) and 110 W (*b*)	Thermostatic, single-heat (*a*) and three-heat (*b*)	Pink, blue and green	Cotton base, wool	Detachable cover	£6 4 3 (*a*) £7 10 6 (*b*)	£1 7 3 (*a*) £1 13 0 (*b*)
	"Norvic" Waffle De-Luxe F.3	36×60	160 W	Thermostatic, three-heat switch	Pink, blue and green	Cotton base, wool	Detachable cover, foot control	£12 8 6	£2 14 6



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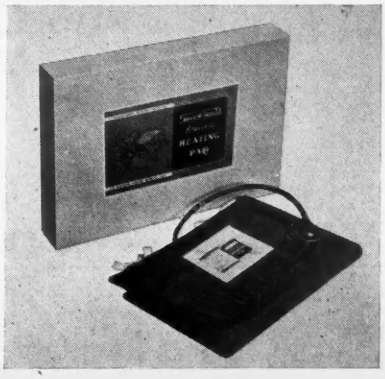

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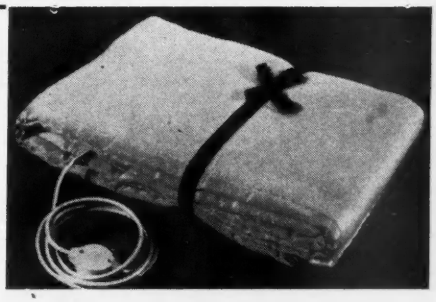

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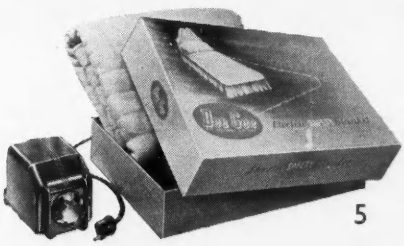
1. H. J. Baldwin & Co.'s "Thermat" medium size
2. Bulpitt "Swan Brand" heating pad
3. Best Products blanket
4. Chalfont blanket

BLANKETS AND PADS . . . . . *continued*

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
DENHAMS (NORWICH), LTD., All Saints Road, Acton, W.3. *(continued)*	"Norvic" 12 V all-night L.3	36×60	120 W	Three-heat through transformer	Pink, blue and green	Cotton base, wool	Price includes transformer	£12 9 0	£1 5 3
	"Norvic" 12 V all-night D.L.3	52×60	140 W	Three-heat through transformer	Pink, blue and green	Cotton base, wool	Price includes transformer	£16 4 8	£1 13 0
	"Corona" single C.1	30×48	75 W	Thermostatic, single-heat	Pink, blue and green	Cotton base, wool	Detachable cover	£3 11 9	£0 15 9
	"Corona" double C.2	44×55	140 W	Thermostatic, single-heat	Pink, blue and green	Cotton base, wool	Detachable cover	£6 7 2	£1 7 10
DOWSING CO. (ELECTRICAL MANUFACTURERS), LTD., Kangley Bridge Road, Lower Sydenham, S.E.26.	"New Popular" single	52×30	72 W	D/P in-line switch	Peach	Woollen	Rayon cover 17/1 extra	£4 1 11	£0 18 0
	"New Popular" double	52×52	135 W	D/P in-line switch	Peach	Woollen	Rayon cover 29/11 extra	£6 11 0	£1 8 9
EASIPOWER, LTD., 213-215, Gloucester Place, London, N.W.1.	"Easipower" de-luxe single	60×30	90 W	Single-heat	Pastel pink	Woollen	Pastel pink cover available 15/- extra	£3 10 0	£0 15 4
	"Easipower" de-luxe double	60×48	120 W	Single-heat	Pastel pink	Woollen	Pastel pink cover available 25/- extra	£5 15 0	£1 5 2
ELECTRIC BED-WARMERS, LTD., Commercial Street, Hebden Bridge, Yorks.	"Bedtime Bliss" single	30×54	120 W	Three-heat switch	Pink, blue, gold or green	Duplex cloth whipped with wool	"Calomatique z" long-life element	£6 19 5	£1 8 7
	"Bedtime Bliss" double	50×60	200 W	Two three-heat switches	Pink, blue, gold or green	Duplex cloth whipped with wool	"Calomatique z" long-life element, dual-control	£13 18 10	£2 17 2
	"Bedtime Bliss" de-luxe single	30×54	120 W	Three-heat switch	Pink, blue, gold, rose or green	Wool mixture, satin bound	"Calomatique z" long-life element	£8 1 10	£1 13 2
	"Bedtime Bliss" de-luxe double	50×60	200 W	Two three-heat switches	Pink, blue, gold, rose or green	Wool mixture, satin bound	"Calomatique z" long-life element, dual-control	£16 3 8	£3 6 4
	"Calora" pad de-luxe major	13×18	80 W	Three-heat switch	White	Duplex cloth	Guaranteed two years	£3 14 8	£0 15 4
ELECTRO-MEDICAL BLANKETS, LTD., Nugent Street, Leicester.	"Paramount Gold Label" single	30×60	85 W	Self-compensating element, single-heat switch	Pink and blue	Heavy blanket cloth	—	£5 15 0	£1 5 3
	"Paramount Gold Label" double	48×60	125 W	Self-compensating element, single-heat switch	Pink and blue	Heavy blanket cloth	—	£9 5 0	£1 13 10
S. I. ENGEL, 23-5, Kensington Park Road, London, W.11.	"L'Exquisite"	12×16	60 W	Three-heat switch	White	Flannelette	Complete with washable cover, two thermostats	£1 19 5	£0 8 1
FALK, STADELMANN & CO., LTD., 91, Farringdon Road, London, E.C.1.	"Sleepwarm" U.95662	50×30	100 W	Single-heat switch, thermostatic	Gold, pink and blue	Fleecy wool/cotton mixture	Satin edging and bow	£5 10 0	£1 4 2
	"Sleepwarm" U.95726	50×30	100 W	Three-heat switch, thermostatic	Gold, pink and blue	Fleecy wool/cotton mixture	Satin edging and bow	£7 0 0	£1 10 9
	"Sleepwarm" U.95727	54×48	180 W	Single-heat switch, thermostatic	Gold, pink and blue	Fleecy wool/cotton mixture	Satin edging and bow	£9 5 0	£2 0 7
	"Sleepwarm" U.95728	54×48	180 W	Three-heat switch, thermostatic	Gold, pink and blue	Fleecy wool/cotton mixture	Satin edging and bow	£12 5 0	£2 13 9
THOMAS FRENCH & SONS, LTD., Chester Road, Manchester, 15.	'Vesta" pad Model 6	20×12	50 W	S/P switch, thermostatic	Pale blue, pale green, pink and peach	Flannelette	Damp resistant cover, element woven into glass fibre	£2 2 9	£0 9 4
	"Vesta" Model 7	30×24	50 W	D/P switch, thermostatic	Pale blue, pale green, pink and peach	Flannelette	Damp resistant cover, element woven into glass fibre	£3 13 8	£0 16 1
	"Vesta" Model 8	54×30	160 W	Three-heat switch, thermostatic	Pale blue, pale green, pink and peach	Flannelette	Damp resistant cover, element woven into glass fibre	£7 14 0	£1 13 7



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5. *David Griffin "Dee Gee" blanket with transformer*
6. *Electric Bedwarmers "Bedtime Bliss" blankets*
7. *Thomas French & Sons "Vesta"*
8. *Falk Stadelmann "Sleepwarm"*
9. *Hall & Veret bedwarmer*
10. *Dowsing "New Popular"*

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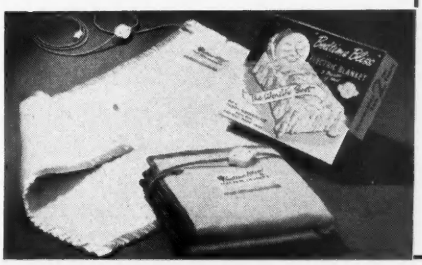

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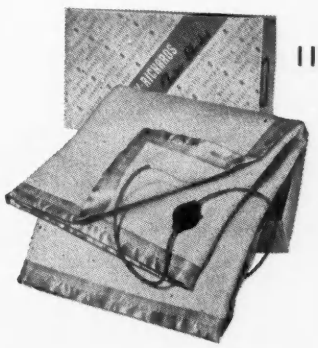
Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
THOMAS FRENCH & SONS, LTD., Chester Road, Manchester, 15. *(continued)*	"Vesta" Model 9	60×48	235 W	Multi-position switch unit, thermostatic	Pale blue, pale green, pink and peach	Flannelette	Damp resistant cover, element woven into glass fibre	£12 2 9	£2 13 0
	"Vesta" Model 10	54×30	60 W	S/P switch, non-thermostatic	Pale blue, pale green, pink and peach	Flannelette	Element woven into glass fibre	£4 1 10	£0 17 11
DAVID GRIFFIN, LTD., 39, Wimborne Road, Poole, Dorset.	"Dee Gee" SB/SU	70×34	90 W	Three-heat switch through transformer	Pink and blue	Wool	Operates at 12 V	£9 9 3	£1 0 9
	"Dee Gee" TSB/DU	70×34 (twin)	2×90 W	Three-heat switch through transformer, dual control	Pink and blue	Wool	Operates at 12 V	£17 17 6	£2 1 6
	"Dee Gee" DB/DU	70×54	2×90 W	Three-heat switch through transformer, dual control	Pink and blue	Wool	Operates at 12 V	£17 0 4	£1 17 8
	"Dee Gee" DB/TSU	70×54	2×90 W	Three-heat switch through transformer, dual control	Pink and blue	Wool	Operates at 12 V	£18 1 4	£1 17 8
	"Riviera" RS.1 and RS.2	70×31	115 W	Three-heat switch	Pink and blue	Wool mixture	RS.1 200/220 V RS.2 230/250 V	£6 9 7	£1 8 5
	"Riviera" RD.1 and RD.2	70×48	190 W	Three-heat switch, dual control	Pink and blue	Wool mixture	RD.1 200/220 V RD.2 230/250 V	£10 6 8	£2 5 4
HALL & VERET, LTD., 434, Rochester Way, Sidcup, Kent.	"Veret" bedwarmer	9×3	6·5 W	Thermostatic	Red and black mottled container	Toughened heavy gauge Bakelite	Suppressed for radio and T.V.	£1 14 0	£0 7 8

BLANKETS AND PADS . . . . . *continued*

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
HOLT ENGINEERING & MANUFACTURING CO., LTD., Hemco Works, 210, Stockport Road, Manchester, 13.	"Hesco"	17×11	33 W	Single-heat switch	White	Woollen	White linen and/or waterproof cover 5/- extra	£2 0 0	£0 8 9
	"Hesco"	22×14	30 W	Single-heat switch	White	Woollen	White linen and/or waterproof cover 5/- extra	£3 10 0	£0 15 0
	"Hesco"	22×14	60 W	Three-heat switch	White	Woollen	White linen and/or waterproof cover 5/- extra	£3 15 0	£0 16 6
	"Hesco"	47×32	125 W	Single-heat switch	White	Woollen	White linen and/or waterproof cover £1 extra	£5 0 0	£1 1 11
	"Hesco"	47×32	260 W	Three-heat switch	White	Woollen	White linen and/or waterproof cover £1 extra	£6 15 0	£1 9 7
	"Hesco"	60×48	520 W	Three-heat dual switch	White	Woollen	White linen and/or waterproof cover 30/- extra	£12 0 0	£2 12 7
ROBERT HOLT (MIDDLESEX), LTD., Florence Road, Edmonton, N.18.	"Solwarm" No. 1	50×50	120 W	Duplicate thermostats	Cream	Cotton	Washable cover 30/- extra	£6 13 6	£1 10 0
	"Solwarm" No. 2	36×50	90 W	Single-heat and thermostats (special)	Cream	Cotton	Washable cover 21/- extra	£3 12 8 (standard) £4 6 8 (special)	£0 16 4 (standard) £0 19 0 (special)
	"Solwarm" No. 3	25×50	60 W	Single-heat and thermostats (special)	Cream	Cotton	Washable cover 18/- extra	£3 1 10 (standard) £3 15 9 (special)	£0 14 2 (standard) £0 17 0 (special)
	"Solwarm" No. 4	17×50	40 W	Single-heat and thermostats (special)	Cream	Cotton	Washable cover 14/- extra	£2 11 11 (standard) £3 4 0 (special)	£0 11 7 (standard) £0 14 4 (special)
	"Solwarm" No. 5	11×14	20 W	Thermostatic	Cream	Cotton	Waterproof cover included. Two-heat	£1 12 4	£0 7 2
	"Solwarm" L.2	50×44	130 W	Thermostatic or optional variable control	Cream	Cotton	Washable cover 23/6 extra	£4 8 0	£0 19 6
DAVID HOPE & CO., LTD., Nugent Street, Leicester.	"Nelson"	54×33	85 W	Single-heat switch and thermostat	White	Rayon	—	£6 17 6	£1 10 2
	"Nelson"	54×33	140 W	Three-heat switch and thermostat	White	Rayon	—	£7 10 0	£1 12 11
HOTPOINT ELECTRIC APPLIANCE CO., LTD., Fletton, Peterborough.	"Hotpoint" EB.103	54×30	72 W	On-off cord switch	Golden shade	Wool and cotton mixture	Matching cover 25/- extra	£5 18 0	£1 5 11
HURSEAL, LTD., 229, Regent Street, London, W.1.	"Hurseal" bed sheet, single	60×33	140 W	Three-heat switch, thermostatic	White, pink or blue	Cotton/rayon mixture	Washable	£7 7 6	£1 12 4
	"Hurseal" bed sheet, double	60×51	220 W	Three-heat switch, thermostatic	White, pink or blue	Cotton/rayon mixture	Washable, individual control each side	£12 16 0	£2 16 2
ISOPAD, LTD., 3, Rosemont Road, London, N.W.3.	"Isoblanket Lana" BS	60×80 (36×54 heated)	100 W	Three-heat switch	Pink, green and blue	Pure wool	Unheated part tucks in	£9 16 0	£2 2 6
	"Isoblanket Lana" BS	70×80 (54×60 heated)	160 W	Three-heat switch for each half	Pink, green and blue	Pure wool	Unheated part tucks in, extra large	£19 4 0	£4 3 2
	"Isoblanket Thea" single	30×56	80 W	Three-heat switch	Pink, green and blue	Raised cotton	Fireproof	£5 10 0	£1 3 10
	"Isoblanket Thea" double	50×60	140 W	Three-heat switch	Pink, green and blue	Raised cotton	Fireproof	£8 10 0	£1 16 10
	"Isoblanket Una"	30×48	60 W	Single-heat switch	Pink, green and blue	Raised cotton	Fireproof	£4 0 0	£0 17 4
MILLIWATT, LTD., 44, Princess Road, Regent's Park, N.W.1.	"Milliwatt"	30×50	140 W	Three-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Washable cotton cover	£6 10 0	£1 9 3
	"Milliwatt"	30×50	100 W	Single-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Washable cotton cover	£5 0 0	£1 2 6

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
MILLIWATT, LTD., 44, Princess Road, Regent's Park, N.W.1. *(continued)*	"Milliwatt" dual control	50×60	280 W	Three-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Washable cotton cover	£16 0 0	£3 12 0
	"Milliwatt" double	50×60	200 W	Single-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Washable cotton cover	£13 0 0	£2 18 6
	"Milliwatt" pad	13½×15	80 W	Three-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Washable cotton cover	£3 15 0	£0 16 11
	"Milliwatt" pad	13½×15	80 W	Single-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Washable cotton cover. On-off switch 7/6 extra	£2 2 0	£0 9 6
	"Milliwatt" double pad	15×26	100 W	Three-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Waterproof covers available	£4 15 0	£1 1 5
	"Milliwatt" double pad	15×26	50 W	Single-heat thermostatic	Pink, blue, green and yellow	Felt (wool interior)	Waterproof covers available. On-off switch 7/6 extra	£3 5 0	£0 14 8
MODERN ELECTRICAL INDUSTRIES, LTD., Hollingworth Lane, Knottingley, Yorks.	"Warmabed" double	60×42	135 W	Single (*a*) or three-heat (*b*) switches	Honeysuckle, periwinkle blue, green and pink	Woollen	Auto-transformer temperature regulator available	£10 8 0 (*a*) £11 12 0 (*b*)	£2 5 0 (*a*) £2 10 3 (*b*)
	"Warmabed" single	60×28½	90 W	Single (*a*) or three-heat (*b*) switches	Honeysuckle, periwinkle blue, green and pink	Woollen	Auto-transformer temperature regulator available	£7 4 0 (*a*) £8 0 0 (*b*)	£1 11 2 (*a*) £1 14 8 (*b*)
	"Warmabed" Junior	40×20	41 W	Single-heat switch	Honeysuckle, periwinkle blue, green and pink	Woollen	Auto-transformer temperature regulator available	£4 0 0	£0 17 4
MORPHY-RICHARDS, LTD., 6, Conduit Street, London, W.1.	"Popular" BBU/1 single	48×26	63 W	Single-heat switch	Peach, pink or blue	Cotton	Braided edge	£2 15 6	£0 12 0
	"Popular" BCU/1 double	48×39	100 W	Single-heat switch	Peach, pink or blue	Cotton	Braided edge	£3 12 0	£0 15 7
	"Regent" BS/1 single	60×24	70 W	Single-heat switch	Peach, pink or blue	Wool mixture	Braided edge	£4 0 0	£0 17 4
	"Regent" BD/1 double	60×42½	130 W	Single-heat switch	Peach, pink or blue	Wool mixture	Braided edge	£6 0 0	£1 6 0
	"Imperial" BEU/1 single	60×24	70 W	Three-heat switch	Peach, pink or blue	Wool mixture	Braided edge	£4 15 0	£1 0 7
	"Imperial" BFU/1 double	60×42½	130 W	Three-heat switch	Peach, pink or blue	Wool mixture	Braided edge	£7 0 0	£1 10 4



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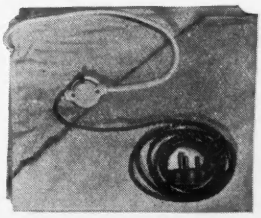

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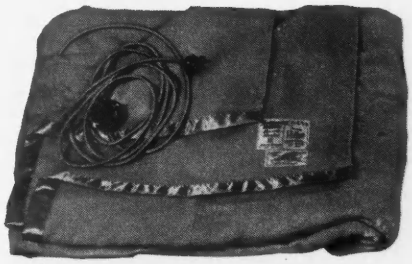

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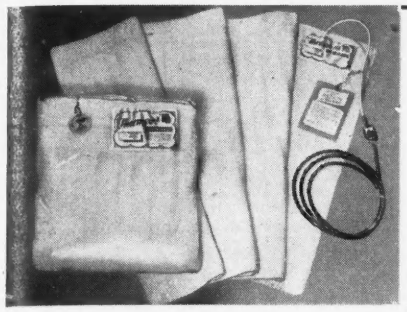
11. *Morphy-Richards blanket*
12. *Hotpoint EB.103 blanket*
13. *Hurseal electric bedsheet*
14. *Isopad "Lana" BS*
15. *Modern Electrical Industries "Warmabed" temperature regulator*

BLANKETS AND PADS . . . . . *continued*

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
PIFCO, LTD., Watling Street, Manchester, 4.	" Favourite " 1267 single	48×26	63 W	Self-compensating element	Gold, peach and eau-de-nil	Heavy cotton twill	Satin ribbon binding	£2 15 4½	£0 12 1½
	" Favourite " 1268 double	48×39	100 W	Self-compensating element	Gold, peach and eau-de-nil	Heavy cotton twill	Satin ribbon binding	£3 11 9	£0 15 9
	" Popular " 1167 single	60×24	70 W	Self-compensating element	Gold, peach and eau-de-nil	Wool and cotton mixture	Satin ribbon binding	£4 0 0	£0 17 6
	" Popular " 1168 double	60×42½	130 W	Self-compensating element	Gold, peach and eau-de-nil	Wool and cotton mixture	Satin ribbon binding	£6 0 0	£1 6 4
	" De-Luxe " 2263 single	62×28	120 W	Thermostatic	Gold, peach, powder blue and eau-de-nil	Pure wool	Satin ribbon binding	£7 3 11	£1 11 7
	" De-Luxe " 2264 double	62×42½	186 W	Thermostatic	Gold, peach, powder blue and eau-de-nil	Pure wool	Satin ribbon binding	£10 7 11	£2 5 7
PREMIER ELECTRIC HEATERS, Keeley Street, Birmingham, 9.	" Dreamwell " De-Luxe B.135	50×24	57 W	D/P switch, self-compensating element	Pink	Blanket material	Covers 17/6 extra	£3 0 0	£0 13 0
	" Dreamwell " Standard B.105	50×24	57 W	Self-compensating element	Cream	Blanket material	Covers 17/6 extra	£2 12 6	£0 11 5
	" Quilty " B.404	54×30	72 W	Self-compensating element	Pink	Fleecy " Duplex "	Poplin covers 25/- extra	£4 12 6	£1 0 1
	" Warmwell " B.205-8	54×30	80 W	D/P switch, self-compensating element	Pink, green, blue and gold	Fleecy material	Poplin covers 25/- extra	£5 18 0	£1 5 7
STANLEY BROS. ALDERSHOT, LTD., Pool Road, Aldershot.	" Cozy "	60×27	110 W (*a*) and 150 W (*b*)	Thermostatic, single (*a*) and three-heat (*b*)	White	Cotton	Cover available 20/- extra	£5 0 0 (*a*) £6 8 0 (*b*)	£1 1 8 (*a*) £1 7 9 (*b*)
	" Cozy "	50×54	190 W	Three-heat thermostatic	White	Cotton	Cover available 32/- extra	£10 0 0	£2 3 4
	" Cozy "	16×12	35 W	Single-heat	White	Cotton	Detachable cover included	£1 16 0	£0 7 10
	" Cozy "	16×22	50 W	Single-heat	White	Cotton	Detachable cover included	£2 10 0	£0 10 10
	" Cozy "	16×24	75 W	Three-heat	White	Cotton	Detachable cover included	£3 12 0	£0 15 7
	" Cumfee "	48×24	65 W	Self-compensating element	White	Cotton	Cover available 15/- extra	£2 9 0	£0 10 7
	" Cumfee "	60×27	90 W	Self-compensating element	White	Cotton	Cover available 20/- extra	£3 5 4	£0 14 2
SUTCLIFFE & CLARKSON, LTD., Whittlefield Mills, Burnley, Lancs.	B.1	53×25	56 W	Illuminated on/off switch	Cream	Raised cotton	—	£2 19 4	£0 13 4
	B.2	53×38	90 W	Illuminated on/off switch	Cream	Raised cotton	—	£3 18 8	£0 17 8
	B.3	53×38	90 W	Three-heat switch	Cream	Raised cotton	—	£4 3 4	£0 18 7
	VR.1	53×25	56 W	Illuminated on/off switch	Cream	Wool mixture	Elements enclosed in " Proban " treated material	£4 4 0	£0 18 11
	VR.2	53×38	90 W	Illuminated on/off switch	Cream	Wool mixture	Elements enclosed in " Proban " treated material	£5 10 4	£1 4 10
	VR.3	53×38	90 W	Three-heat switch	Cream	Wool mixture	Elements enclosed in " Proban " treated material	£5 13 7	£1 5 7
TELSEN ELECTRIC CO. (1935), LTD., 9, Fitzgeorge Street, Collyhurst, Manchester, 9.	" Telsen "	60×30 (single) 60×90 (double)	100 W	Thermostatic. Double size has the twin control feature	Green, blue, pink and peach	Witney blanket finish	Washable, rapid heating	£6 17 6 (single) £11 17 6 (double)	£3 2 3 (single) £5 6 3 (double)



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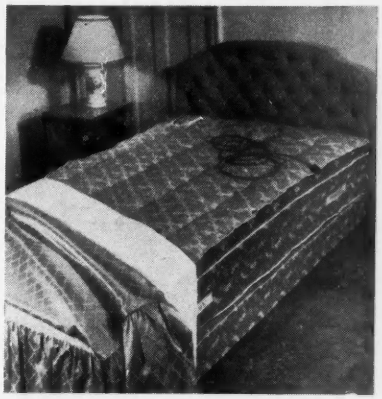
16. *Thermega bedwarmer*
17. *Premier "Dreamwell" blankets*
18. *Stanley Bros. "Cumfee"*
19. *Thermalux Electrical Products mattress overlay*
20. *Pifco "De-luxe"*



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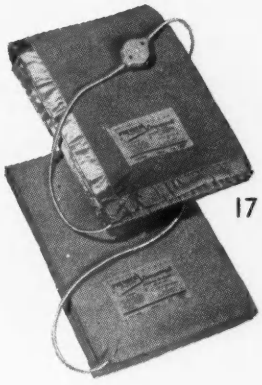

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Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
THERMALUX ELECTRICAL PRODUCTS, LTD., Talbot Works, Halifax.	"Thermalux" mattress overlay Model M	27×48	85 W	Thermostatic	Pink, green or blue	Woollen felt, cotton ticking covering	Hand switch 14/2 extra. Washable cover £1 extra	£5 4 0	£1 2 6
	"Thermalux" mattress overlay Model J	27×72	125 W	Thermostatic	Pink, green or blue	Woollen felt, cotton ticking covering	Hand switch 14/2 extra. Washable cover 26/- extra	£7 8 0	£1 12 0
	"Thermalux" mattress overlay Model OSB	36×72	180 W	Thermostatic	Pink, green or blue	Woollen felt, cotton ticking covering	Hand switch 14/2 extra. Washable cover 35/- extra	£10 0 0	£2 3 4
	"Thermalux" mattress overlay Model DB	54×72	250 W	Thermostatic	Pink, green or blue	Woollen felt, cotton ticking covering	Hand switch 14/2 extra. Washable cover 45/- extra	£13 4 0	£2 17 2
	"Thermalux" mattress overlay Model DB2	54×72	250 W	Two switches control each half separately	Pink, green or blue	Woollen felt, cotton ticking covering	Washable cover 45/- extra	£15 4 0	£3 5 10
THERMEGA, LTD., 51-53, Victoria Street, London, S.W.1.	"Thermega" pad P.1612 and P.1612/3	16×12	70 W (*a*) and 90 W (*b*)	Single (*a*) and three-heat (*b*) thermostatic	White	Wool/ felt/cotton	Complete with covers	£2 6 0 (*a*) £4 0 0 (*b*)	£0 10 0 (*a*) £0 17 4 (*b*)
	"Thermega" pad P.2416/3	24×16	110 W	Three-heat, thermostatic	White	Wool/ felt/cotton	Complete with covers	£5 10 0	£1 3 10
	"Thermega" Domestic single T.5430	54×30	100 W	Thermostatic	White, blue binding	Pure wool	Mothproof, covers 21/- extra	£7 17 6	£1 14 2
	"Thermega" Domestic double T.6048	60×48	200 W	Thermostatic	White, blue binding	Pure wool	Mothproof, covers 45/- extra	£12 10 0	£2 14 2
	"Thermega Bedwarmer" single W.5430	54×30	75 W	Non-thermostatic	White	Pure wool	Mothproof, covers 21/- extra	£6 0 0	£1 6 0
	"Thermega Bedwarmer" double W.6048	60×48	135 W	Non-thermostatic	White	Pure wool	Mothproof, covers 45/- extra	£9 10 0	£2 1 2

BLANKETS AND PADS . . . . *continued*

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
THERMOLECTRICS, LTD., Chapel Works, Church Street, Hampton-on-Thames.	"Siesta" SBA single	60×30	78 W	Self-compensating element	Rose, pastel pink	Mixture	Neon illuminated indicator switch	£3 2 0	£0 13 7
	"Siesta" DBA double	60×50	123 W	Self-compensating element	Rose, pastel pink	Mixture	Neon illuminated indicator switch	£5 0 0	£1 1 11
THERMOSET APPLIANCES, LTD., Failsworth, Manchester.	"New Era" (standard)	50×30	105 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Price includes cover	£7 0 0	£1 10 8
	"New Era" (twin)	60×48	200 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Price includes cover	£14 5 0	£3 2 6
	"New Era" (single)	60×24	105 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Price includes cover	£7 0 0	£1 10 8
	"Regent"	40×28	80 W	Single-heat. Variable heat control unit 39/6 extra	Pale green and cream	"Duplex" material (cotton)	Price includes cover	£5 15 0	£1 5 3
	"Cozee"	60×28	75 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	"Duplex" material (cotton)	Cover 16/- extra	£3 15 0	£0 16 5
	"Everest"	54×28	60 W	Single-heat. Variable heat control unit 39/6 extra	Pale green	Cotton	Cover 16/- extra	£2 18 0	£0 12 9
	"Super"	60×30	75 W	Single-heat. Variable heat control unit 39/6 extra	Biscuit	Pure wool	Cover 16/- extra	£5 10 0	£1 4 1
	"Favourite" pad	18×14	55 W	Single-heat	Pale green and cream	"Duplex" material (cotton)	Price includes cover	£2 15 0	£0 12 1
WARMGLOW CO., LTD., Progress Road, Leigh-on-Sea, Essex.	"Popular" JP	50×28	50 W	Natural heat dissipation	Ivory. Blue ribbon binding	Flame-proofed fleecy cotton	Completely sealed elements	£2 13 4½	£0 11 8½
	"Popular" SP	60×31	72 W	Natural heat dissipation	Ivory. Blue ribbon binding	Flame-proofed fleecy cotton	Completely sealed elements	£3 7 4½	£0 14 9½
	"Popular" DP	60×49	116 W	Natural heat dissipation	Ivory. Blue ribbon binding	Flame-proofed fleecy cotton	Completely sealed elements	£5 1 3	£1 2 2
	"De-Luxe" B	54×36	63 W	Natural heat dissipation	Rose, blue, camel and green	Real wool or flame-proofed wool mixture	Washable, having completely sealed elements. Calico covers available	£6 19 6	£1 10 6
	"De-Luxe C	72×54	108 W	Natural heat dissipation	Rose, blue, camel and green	Real wool or flame-proofed wool mixture	Washable, having completely sealed elements. Calico covers available	£12 0 11	£2 12 9
	"Vigilux" SV	65×36	78 W	Variable temperature control box	Rose, blue, camel and green	Real wool or flame-proofed wool mixture	Washable, having completely sealed elements. Calico covers available	£9 8 9	£2 1 4
	"Vigilux" DV	72×58	140 W	Variable temperature control box	Rose, blue, camel and green	Real wool or flame-proofed wool mixture	Washable, having completely sealed elements. Calico covers available	£14 1 1	£3 1 7
	"Vigilux" TV	72×58	2×70 W	Two variable temperature control boxes	Rose, blue, camel and green	Real wool or flame-proofed wool mixture	Washable, having completely sealed elements. Calico covers available	£16 1 3	£3 10 4
WARMALUX MANUFACTURING CO., LTD., Kion End Mills, Elland, Yorks.	"Warmalux" single	50×26	75 W	Single-heat switch	Pink	Cotton mixture	Waterproof elements	£2 10 10	£0 11 2
	"Warmalux" three-quarter	50×40	110 W	Single-heat switch	Pink	Cotton mixture	Waterproof elements	£3 18 0	£0 17 0

Manufacturer	Name or Model	Size (inches)	Maximum Loading	Method of Heat Control	Colour	Material	Special Features	Price (excl. tax)	Purchase Tax
WARMALUX MANUFACTURING CO., LTD., Kion End Mills, Elland, Yorks. *(continued)*	" Warmalux " double	50×48	120 W	Single-heat switch	Pink	Cotton mixture	Waterproof elements	£4 13 1	£1 0 5
	" Warmalux " SBL	60×30	115 W	Single-heat switch	Cream	Pure wool	Waterproof elements, satin bound	£5 11 3	£1 3 9
WARMEX, LTD., 375, Milton Road, Cambridge.	" Warmex " Standard single	50×24	80 W	Self-compensating element, single-heat	Cream	Cotton	Illuminated safety switch	£2 17 8	£0 11 4
	" Warmex " Standard large	50×30	100 W	Self-compensating element, three-heat	Cream	Cotton	Illuminated safety switch	£5 13 3	£1 1 9
	" Warmex " Standard double	50×48	160 W	Self-compensating element, single (*a*) and three-heat (*b*)	Cream	Cotton	Illuminated safety switch	£5 15 4 (*a*) £8 5 6 (*b*)	£1 2 8 (*a*) £1 13 6 (*b*)
	" Warmex " De-Luxe single	50×24	80 W	Thermostatic, single-heat	Cream	Cotton	Illuminated safety switch	£3 8 8	£0 14 4
	" Warmex " De-Luxe large	50×30	100 W	Thermostatic, three-heat	Cream	Cotton	Illuminated safety switch	£6 11 3	£1 3 9
	" Warmex " De-Luxe double	50×48	160 W	Thermostatic, single (*a*) and three-heat (*b*)	Cream	Cotton	Illuminated safety switch	£6 17 4 (*a*) £8 19 1 (*b*)	£1 8 8 (*a*) £1 15 11 (*b*)
WINDAK, LTD., Woodside, Poynton, Cheshire.	" Windak " single	70×33	200 W	Step-down transformer 240–24–18–12 V	Pink/gold check	Cotton	Low-voltage. Price includes transformer	£13 2 0	£1 8 0
	" Windak " double	70×52	200 W	Step-down transformer 240–24–18–12 V	Pink/gold check	Cotton	Low-voltage. Price includes transformer	£15 2 9	£1 17 3
	" Windak " twin	Two 70×33	200 W	Step-down transformer 240–24–18–12 V	Pink/gold check	Cotton	Low-voltage. Price includes transformer	£18 6 4	£2 13 8
WYE VALLEY HAND WEAVERS, Ross-on-Wye, Herefordshire.	" Wye Valley "	54×31	88 W	Resistance	Cream (*a*), blue, green or gold (*b*)	Cotton or flannelette cover	Hand woven element. Cover extra, white 20/-	£4 3 2 (*a*) £5 0 0 (*b*)	£0 18 9 (*a*) £1 2 6 (*b*)
	" Wye Valley "	54×60	142 W	Resistance	Cream (*a*), blue, green or gold (*b*)	Flannelette cover	Hand woven element. Cover extra, white 20/-	£8 6 4 (*a*) £10 0 0 (*b*)	£1 17 6 (*a*) £2 5 0 (*b*)
YELSEN, LTD., Ruxley Corner, Sidcup, Kent.	" Yelsen " De-Luxe large double	62½×54	240 W	Single (*a*) and three-heat (*b*), thermostatic	Gold, peach or blue, satin bound	Pure wool	—	£14 8 0 (*a*) £16 16 0 (*b*)	£3 2 5 (*a*) £3 12 10 (*b*)
	" Yelsen " De-Luxe double	62½×42½	186 W	Single (*a*) and three-heat (*b*), thermostatic	Gold, peach or blue, satin bound	Pure wool	—	£10 8 0 (*a*) £13 0 0 (*b*)	£2 5 1 (*a*) £2 16 4 (*b*)
	" Yelsen " De-Luxe single	62×28	120 W	Single (*a*) and three-heat (*b*), thermostatic	Gold, peach or blue, satin bound	Pure wool	—	£7 4 0 (*a*) £8 8 0 (*b*)	£1 11 3 (*a*) £1 16 5 (*b*)
	" Yelsen " Popular single	50×30	100 W	Single (*a*) and three-heat (*b*)	White with satin bindings in sky, pink or champagne	Wool and cotton	—	£5 10 0 (*a*) £7 0 0 (*b*)	£1 3 10 (*a*) £1 10 4 (*b*)

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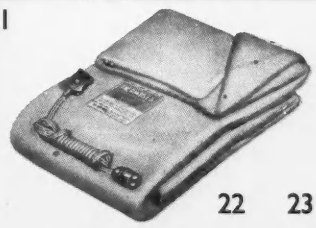

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21. *Wye Valley Hand Weavers blanket with covers*
22. *Thermoset Appliances " New Era "*
23. *Yelsen " De-Luxe " model*
24. *Windak safety blanket with transformer*

GENERATION AND DEVELOPMENT

Output in July

Last month 5,840 million kWh was generated by the Central Electricity Authority, the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board. This was an increase of 725 million kWh, or 14·2 per cent, as compared with the corresponding month of 1955, the average rate of increase for the first seven months of this year being 9·5 per cent, as shown in Table 1.

At the end of July the total capacity of plant installed was 23,025 MW, as compared with 21,090 MW for July, 1955.

Plant installed in C.E.A. stations last month included a 550,000 lb/hr Simon-Carves boiler at Hams Hall "C," a 550,000 lb/hr John Thompson boiler at Marchwood, a 150,000 lb/hr Bennis Combustion boiler at Northampton H.P., a 305,000 lb/hr Simon-Carves boiler at Huncoat, and a 180,000 lb/hr John Thompson boiler at East Yelland.

The monthly statement of the Ministry of Fuel and Power shows that electricity production by the principal industries in July (July, 1955, figures in parentheses) was as follows:—Chemicals, 197 million kWh (190·9); iron and steel, 155·6 million kWh (135·1); engineering, 80·2 million kWh (72·7); textiles, leather and clothing, 45·2 million kWh (46·7); food and drink and tobacco, 15·1 million kWh (17·7); paper, 122·4 million kWh (109·3); other industries, 27·5 million kWh (33·6).

The sales of the twelve Electricity Boards in England and Wales last month are given in Table 2. It will be seen that the national figures show an increase over July, 1955, of 14·4 per cent, but when corrected for weather conditions and working days, the increase is 8·2 per cent.

Sussex Skyline "Spoilt"

At a meeting of the Seaford U.D.C. a letter was read from residents deprecating the recent erection of overhead electricity lines across Hill Rise towards East Blatchington. Mr. R. H. Forrest, a member of the Council, said that, apparently to save money, the Electricity Board had spoilt one of the best skylines in Seaford, in Sussex, and therefore in England.

Painted Pylons?

Cardiff R.D.C. recently made a request that electricity pylons should be painted green to blend with the landscape. In reply, the South Wales Electricity Board said it had been found that the countryside was more often brown than green and the sky grey rather than blue, and a neutral tone of steel grey had therefore been adopted which blended with the landscape and sky.

Commenting on the Cardiff suggestion, the *Western Mail* said: "Green pylons to match the fields and forests with an occasional brown one here and there to match the mud, would be a notable enhancement of Britain's scenic beauty. Nor must the Council assume that they have exhausted the possibilities of the idea. Why should not a pylon erected near an old country cottage be painted to resemble a tulip? The next one might be striped like a barber's pole, and so on. But Cardiff Rural District Council has the right idea; the important thing, above all else, is that pylons should not go on looking like pylons."

Cooking Facilities at Crook

Crook (Co. Durham) U.D.C. has deferred a decision for a month on the question of installing electric cookers in Council houses in place of solid fuel cookers. Representatives of the North Eastern Electricity Board said that it had cost the Board £26 per house, and in some cases £60, to supply electricity to new houses, but the revenue was small if cookers were not used. It was pointed out that cookers would cost about £24 each to install, but on the other hand the Council would be able to install dining room fireplaces with backboilers at £14 to £16 each, instead of solid fuel ranges costing about £40.

Floor Warming for Maisonnettes

Felling (Co. Durham) U.D.C. is to install electric floor warming in four-storey maisonnettes to be built in the Wellington Street area.

Speedy Cable Laying

In six hours the Contracting Section of the London Electricity Board laid two ·04/3 11 kV and two 15-pair 20 lb polythene insulated control cables across the River Stour at Sandwich, Kent. The installation is described by Mr. L. E. W. Humphries in the July-August issue of *London Electricity* under the title of "Operation 'Ebb Tide'." Owing to a difference of 20ft

TABLE 1.—ELECTRICITY GENERATED AND PLANT INSTALLED

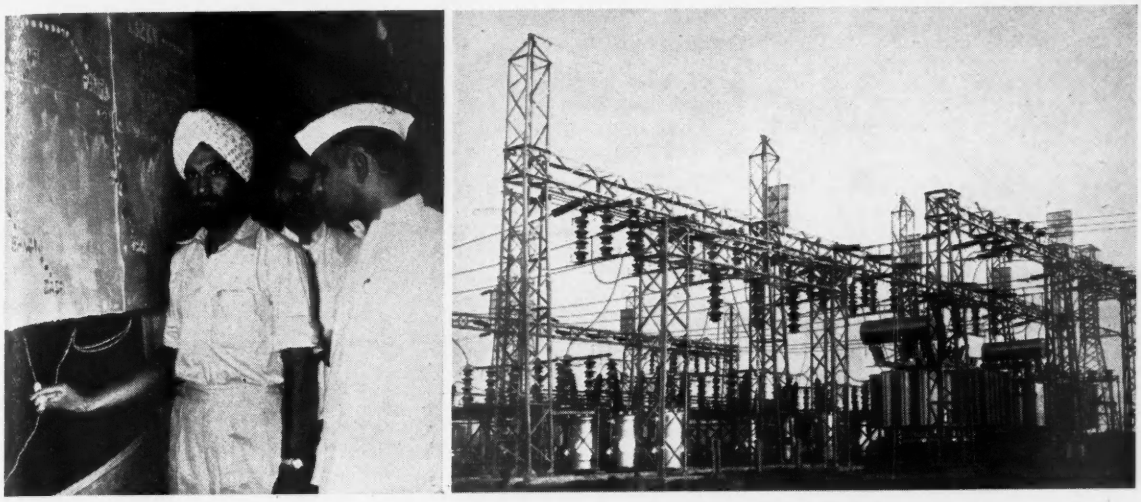
	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity Authority ...	2,808	64	31·4	5,430	5	5,442	5,092	21,059
North of Scotland H.E.B. ...	14	—	1·1	20	59	83	81	748
South of Scotland E.B.	163	6	0·1	300	15	315	299	1,218
Total for July, 1956	2,985	70	32·6	5,750	79	*5,840	5,472	23,025
Corres. total for July, 1955 ...	2,655	65	10·9	5,049	55	5,115	4,786	21,090
Inc. or dec., per cent	+12·4	+8·5	+199·5	+13·9	+44·6	+14·2	+14·3	+9·2
Total to date (7 months), 1956 ...	25,912	561	240·0	49,621	797	50,519	47,459	
Total for corres. 7 months of 1955	24,142	673	136·5	45,299	752	46,148	43,389	
Inc. or dec., per cent	+7·3	−16·6	+75·8	+9·5	+6·0	+9·5	+9·4	

* The total figure includes generation by other methods amounting to 11 million kWh.

TABLE 2.—ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Area Board	Totals for July (Million kWh)			Twelve Months Totals Ended July (Million kWh)		
	1955	1956	Inc. or Dec. %	1955	1956	Inc. or Dec. %
London	370·3	415·2	+ 12·1	6,320·7	6,846·2	+ 8·3
South Eastern	244·0	283·3	+ 16·1	3,833·6	4,316·7	+ 12·6
Southern	295·2	350·2	+ 18·6	4,632·1	5,178·9	+ 11·8
South Western	163·4	192·5	+ 17·8	2,396·1	2,655·0	+ 10·8
Eastern	392·4	454·2	+ 15·7	6,209·1	6,854·4	+ 10·4
East Midlands*	361·8	418·3	+ 15·6	5,436·5	5,892·1	+ 8·4
Midlands*	452·8	523·6	+ 15·6	7,196·9	7·683·2	+ 6·8
South Wales*	307·1	334·9	+ 9·1	4,167·8	4,455·2	+ 6·9
Merseyside and N. Wales* ...	294·7	344·0	+ 16·7	4,229·7	4,647·4	+ 9·9
Yorkshire*	474·9	554·3	+ 16·7	7,040·7	7,666·8	+ 8·9
North Eastern*	287·9	321·4	+ 11·6	4,099·3	4,397·8	+ 7·3
North Western*	499·0	556·3	+ 11·5	7,670·7	8,139·3	+ 6·1
Total all Area Boards	4,143·5	4,748·2	+ 14·6	63,233·2	68,733·0	+ 8·7
Direct Supplies by Central Authority	160·4	175·2	+ 9·2	1,703·3	2,084·2	+ 22·4
Grand Total	4,303·9	4,923·4	+ 14·4	64,936·5	70,817·2	+ 9·1
Mainly Industrial Areas*	2,678·2	3,052·8	+ 14·0	39,841·6	42,881·8	+ 7·6
Mainly Non-Industrial Areas ...	1,465·3	1,695·4	+ 15·7	23,391·6	25,851·2	+ 10·5

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.



Sarda Dilba Singh Chadda, an English Electric electrician, inaugurates the Hansi substation (seen on the right) of the Nangal Power Project. With him is Professor Sher Singh, Minister for Revenue, Irrigation and Power, East Punjab

between tides at this point, it was found that 16th May was the most suitable day, the possible working period being from 7 a.m. to 3 p.m.

The specification called for the cables to be laid at a minimum depth of 2ft 6in below the river bed, and it was decided to use two 1 cu yd dragline excavators working from each bank to dredge a trench below the river bed. Arrangements were made for a boat and crew to be at the point of dredging to take soundings and to help carry the cables across the river.

Dredging started at 7 a.m. and soundings taken at 10 a.m. gave the depth of dredging as 7ft below the river bed level. The width of the river crossing was 85ft. By 3 p.m. the work had been completed, including the river bank and trench reinstatement.

Londonderry Power Station Site

After considering plans by the Northern Ireland Ministry of Commerce for building a generating station at Coolkeeragh the Londonderry Electricity Committee has passed a resolution recording its "deep disappointment that the Ministry has considered it inadvisable to proceed with the erection of the new generating station on a site within the city," but saying that in its opinion no useful purpose would be served by lodging a formal protest. Originally the Ministry had asked for and been granted a site forming the sports stadium at St. Columb's Park for a new station costing £4,500,000. Borings were being carried out for the architects when the Ministry announced that the site had been changed to Coolkeeragh, near Lisahally, some miles from the city.

Proposed Increase in Belfast Charges

Belfast City Council, at its monthly meeting to be held on 3rd September, is being recommended to approve an increase of approximately 7½ per cent in the basic rates for all supplies of electricity, other than those for shipyards, traffic signs and street lighting, which are subject to special arrangements. The recommendation was adopted last week by the Electricity Committee when the annual report of the electrical engineer (Mr. R. P. Watson) for the year ended 31st March last was submitted showing a considerably smaller net surplus (£13,643 as compared with £114,419 in the previous year).

In his report Mr. Watson pointed out that the increases in loan charges, salaries and wages during the year amounted to approximately £190,000 and there was likely to be a further increase of similar magnitude during the current financial year. It was evident, he said, that improvements in generating efficiency and increased sales no longer offset the rate at which costs continued to rise. So far as could be foreseen the proposed increase in tariffs, together with an expected expansion in sales, would be sufficient to meet the anticipated increased costs. Should there be a falling off in sales during the current year, however, or any further increase in costs, it might be necessary to review tariffs again. The last review took place in 1952, when the overall increase imposed on the tariffs affected was 6·67 per cent.

Nangal Power Project

The Hansi substation of the Nangal Power Project, India, which was recently commissioned, is one of eleven substations of this scheme that are being equipped by the English Electric Co., Ltd. It contains four 132 kV 2,500 MVA and five 33 kV 250 MVA oil circuit-breakers and two 6,000 kVA 132/33/11 kV transformers. Power is transmitted from Hansi some 200 miles to Delhi substation, which was also equipped by the English Electric Co. and which includes two 38,000 kVA 132 kV transformers, among the largest supplied to India. In his speech at the inaugural ceremony Professor Sher Singh, Minister for Revenue, Irrigation and Power, East Punjab, said that in a democratic world people in his position had less right than the workers themselves to perform such ceremonies and he therefore called upon Sarda Dilba Singh Chadda, an English Electric electrician, to perform the opening ceremony.

"Gold Rush" at Roxburgh

The opening of the Roxburgh Dam, New Zealand's biggest hydro-electric undertaking, on 23rd July was preceded by one of the strangest sights ever seen in the historic and colourful gold-rush regions of Central Otago. For 36 hours before the first two of the projected eight 40,000 kW generators were started up the sluice gates shut off the flow of the Clutha and the announcement that the flow of the river through the Roxburgh Gorge would be reduced to an insignificant trickle led to the 1956 "gold rush."

Below the dam the river in places fell as much as 8ft below the previous record low level of 1932. Groups of gold seekers were clustered along the scarred rocky slopes of the river bank for 30 miles below the dam. One group operated a bulldozer and several more had tractors which they used for pumping and sluicing. But the Clutha proved a disappointment. Though it had yielded many millions of pounds worth of gold in the 19th century, the pickings in 1956 were very lean.

Hundreds of those who came remained for the dam's opening day. Standing along the wild and barren slopes of the Old Man Range, they saw the culmination of 12 years' work. Roxburgh Dam will contribute, at full capacity, 320,000 kW to the South Island electricity network, more than doubling the amount of power at present available in the island.

Financial Section

STOCKS and SHARES

FOR the time being, Stock Exchange prices must of course be expected to follow the current of opinion about the outcome of the Suez problem. By the beginning of this week prices in both the gilt-edged and industrial markets had recovered much of the setback caused by the first impact of the crisis. Government securities, indeed, had more than made good all the lost ground, thanks partly to the improvement shown in the latest overseas trade returns. Quotations for British Electricity stocks were mostly marked up by a full point. By volume, the amount of investment business has remained small. Company news is scanty at this season, but in the electrical field the annual results of Thorn Electrical Industries made a good impression.

Peak Prices

While the past week produced few price changes of any particular note in the electrical equipment market, special reference is due to the rise in the shares of C. A. Parsons and A. Reyrolle to their highest quotations of the year, the former to 95s and Reyrolles to 115s. That this is a rare distinction can be judged from the fact that the average of industrial share prices, according to the accepted indices, has fallen by some 9 per cent since January. Another measure of the investment confidence reposed in the future of these enterprises is the fact that in both cases the yield on the shares is well under 3 per cent, calculated on current rates of dividend. Clarke Chapman £1 shares, in rising to 117s 6d, also exceeded their previous best price during the course of this year.

Globe Telegraph Issue

Dealings began this week in the new 5s ordinary shares of Globe Telegraph & Trust at a premium of 4s 9d on the price of 5s at which they are offered to existing holders. Payment in full for the shares is due by 21st September. Meanwhile they are transferable free of the usual 2 per cent stamp duty, and at the all-in price of 9s 9d, show a yield of 5·1 per cent on the basis of the 10 per cent rate of dividend paid for the past two years. Dividend policy of the Trust was dealt with by Sir Edward Wilshaw at the annual meeting held a day or two before the issue. He envisages a regular dividend of 10 per cent, likely to be maintained year in year out rather than to fluctuate with trading conditions, and the offer of occasional scrip or rights issues, such as the one now in progress, on advantageous terms.

"Break-up" Value

Quoted investments held by the Globe Telegraph & Trust are shown in the latest balance sheet at a total of £7·8 million, and had a market value of almost double that figure at the end of June. In addition unquoted securities are shown at £2·4 million, and are stated to be worth substantially more. On the basis of market values, the "break-up" value of the 5s shares

Price Changes in

Company or Board	Nom. Value	Middle price 20th Aug.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1956 Highest	1956 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	75½	+1	3	3	3 19 6	80½	74½
Brit. Elec. 1974/77	100	72½x.d.	+1	3	3	4 2 9	79⅝	71⅝
Brit. Elec. 1976/79	100	78⅛	+1	3⅜	3⅜	4 9 3	84	77⅛
Brit. Elec. 1974/79	100	89	+½	4¼	4¼	4 15 6	95	88
Overseas Electric Supply								
Calcutta Elec.	£1	20/3		6†	6†	5 18 6†	20/9	19/-
East African Power	£1	19/6	−6d	7	7	7 3 6	21/3	19/6
Nigerian Elec.	£1	17/6		10	10*	11 8 6	21/-	17/-
Palestine Elec. "A"	£1	21/-		Nil	Nil	Nil	21/-	21/-
Perak Hydro-Elec.	£1	16/-		10	10	—	17/6	14/9
Equipment and Manufacturing								
Aberdare Cables	5/-	11/6	+3d	17½	17½	7 12 3	13/6	10/6
Aerialite	1/-	4/6	−3d	88⅛	45*	10 0 0	6/9	4/9
Allen, W. H.	£1	36/3		20	10*	5 10 3	39/-	33/6
Aron Elec. Ord.	£1	55/9		15	15	5 7 6	56/-	53/6
Assd. Automation	10/-	17/6	−6d	10	5	2 17 3	19/-	17/-
Assoc. Elec. Ord.	£1	68/9		14	15	4 7 3	85/6	57/9
Automatic Tel. & El.	£1	57/6		15	15	5 4 3	72/6	56/3
Babcock & Wilcox	£1	75/9	+1/-	15	15	3 19 3	85/6	64/-
Baldwin, H. J.	2/-	5/-		20	20	8 0 0	5/-	3/9
Bakelite	10/-	27/6		16	16	5 16 6	34/-	26/9
Berry's Electric	5/-	6/3		—	10‡	8 0 0	6/6	5/9
British Aluminium	£1	78/9		12	12	3 0 6	78/9	40/6
B.I. Callender's	£1	50/-	+1/-	10	12½	5 0 0	54/3	45/-
B.I. Callender's 6% Pref. ...	£1	21/9		6	6	5 10 3	22/6	20/3
British Thermostat	5/-	25/-		20	25	5 0 0	31/9	24/6
British Vac. Cleaner	5/-	7/-		30	15*	10 14 3	8/9	6/-
Brook Motors	10/-	31/9		20	25	7 17 6	44/-	31/9
Brush Ord.	5/-	5/9		10	10	8 14 0	7/9	5/9
Bulgin, A. F.	1/-	4/9		45	50	—	5/3	4/3
Burco Dean	5/-	8/6	+3d	—	22½	13 4 9	13/3	8/3
Chloride El. Storage "A" ...	£1	63/3	+1/3	17½	17½	5 10 9	73/6	60/9
Clarke Chapman	£1	117/6	+2/6	20	22½	3 16 6	117/6	89/6
Cole, E. K....	5/-	17/6	+3d	17½	17½	5 0 0	22/3	15/6
Cossor, A. C.	5/-	7/-		10	15	10 14 3	10/3	6/9
Crabtree	10/-	26/-	−1/-	20	20	7 13 9	29/3	26/-
Crompton Parkinson Ord. ...	5/-	13/3		20	16*	6 0 9	15/-	12/3
De La Rue	5/-	16/3		30	30	9 4 6	20/3	15/-
Decca "A"	4/-	26/3x.d.		56½	43¾*	6 16 6	44/9	24/9
Desoutter	5/-	30/6		25	30	4 18 3	32/9	25/9
Dewhurst	2/-	6/6		24	30	—	7/6	5/3
Dictograph Tel.	2/-	5/6		20	20	7 5 6	6/9	5/6
Dubilier Condenser	1/-	4/6x.d.		25	30	6 13 3	4/9	3/6
E.M.I.	10/-	26/6	+1/-	10	15	5 13 3	37/-	25/6
Electrical Components	5/-	13/9x.d.		25	25	9 1 9	16/-	12/6
Elec. Construction	£1	23/9		8½	8½	7 2 3	29/9	23/9
Enfield Cable Ord.	£1	14/3	−6d	Nil	Nil	Nil	19/3	13/6
English Electric	£1	52/6		12½	12½	4 15 3	66/3	47/3
English Electric 3¾% Pref. ...	£1	13/-		3¾	3¾	5 15 6	14/6	12/6
Ericsson Tel.	5/-	36/-	+6d	20†	20†	2 15 6†	42/9	33/6
Ever Ready	5/-	27/-	+3d	35	35	6 9 9	32/9	24/-
Falk Stadelmann	£1	36/9	−3d	15	17½	9 10 6	45/9	36/9
G.E.C. Ord.	£1	52/6		12½	14	5 6 9	65/6	50/-
G.E.C. 6½% Pref.	£1	22/3		6½	6½	5 16 9	23/9	21/3
General Cables	5/-	11/3		30	30	13 6 9	13/9	11/3
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	47/6	45/-
Hackbridge Cable	5/-	21/9		25	30	6 18 0	34/6	18/9
Hackbridge & Hewittic	5/-	18/3		30	23*	6 6 0	22/-	17/3
Heatrae	2/-	3/9		15	15	8 0 0	5/1	3/9
Henley's	10/-	16/9	+1/-	10½	11½	6 17 3	19/9	14/-
Holophane	5/-	20/6	+6d	25	30	7 6 3	20/6	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend forecast.

is calculated to be about half as much again as their present quotation of under 10s. From the earnings point of view, the record is one of consistent expansion since the reorganisation of 1951. Gross investment income has been doubled over that period, and in the latest twelvemonth topped the million mark for the first time.

Brook Motors

The newly issued 10s ordinary shares of Brook Motors, now paid up in full, will continue to be available in the form of renounced allotment letters, and therefore free of the 2 per cent transfer stamp duty, until the middle of next month. They are quoted at 33s. On the subject of dividend prospects, a statement from the company accompanying the notice of the issue reported a continuance of satisfactory trading results during the current year, which ends in September. Profits were expected to be not less than those of the previous twelve months, in which case a final dividend of 20 per cent on the increased capital would be recommended. With the interim already paid, this would make a total of 25 per cent, on which basis the prospective return on the shares works out at rather more than 7½ per cent. Last year the final payment was declared in November.

Electrical Investments

Company or Board	Nom. Value	Middle price 20th Aug.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1956 Highest	1956 Lowest
Equipment and Manufacturing—continued								
Hoover	5/-	23/6x.d.		70	50	10 12 9	39/3	23/-
I.C.I.	£1	44/6	+9d	10	10	4 10 0	49/9	41/3
Intl. Combustion	5/-	18/6		25	20*	5 8 0	25/-	15/3
Johnson & Phillips	£1	40/9		15	15	7 7 3	46/6	37/6
Lancashire Dynamo	£1	42/6		15	11*	5 3 6	49/9	40/9
Laurence, Scott	5/-	15/3		12½	15	4 18 3	16/9	13/3
Lister, R. A.	£1	28/9		9·3	10	6 19 0	35/3	27/6
London Elec. Wire	£1	48/9	+6d	12½	12½	5 2 6	52/9	46/5
Lucas, J.	£1	32/6	+1/3	7½	7½	4 12 3	40/3	29/6
Marryat & Scott	2/-	10/-		30	30	6 0 0	11/3	9/6
Mather & Platt	£1	52/6x.d.		15	15	5 14 3	65/3	51/6
Metal Industries	£1	17/6		9	9	—	27/-	16/3
Midland Elec. Mfg.	£1	45/-		10	12½	5 11 0	48/6	43/6
Morphy-Richards	4/-	20/-		35	50	10 0 0	27/3	20/-
Murex	£1	67/6x.d.	−9d	20	20	5 18 6	70/3	60/-
Newman Ind.	2/-	2/3		10	10	8 17 9	2/9	2/1
Oldham & Son	1/-	2/3		20	17½*	7 15 6	3/-	2/3
Parnall (Yate)	5/-	5/6	−3d	14	12	10 18 3	9/6	5/6
Parsons, C. A.	£1	95/-	+5/-	10	10	2 2 0	95/-	61/6
Plessey	10/-	69/9	+1/-	27½	30‡	4 6 0	87/6	56/-
Pye "A" Deferred	5/-	17/-		12½	12½	3 13 6	21/3	14/-
Revo	10/-	14/3		9	9	6 6 3	14/6	8/3
Reyrolle	£1	115/-	+5/-	15	16½	2 16 6	115/-	81/-
Rheostatic	4/-	9/9	+3d	18½	12‡	4 19 0	—	8/3
Richardsons Westgarth	5/-	15/-	−6d	16⅝	16⅝	5 11 3	17/-	13/9
Scottish Cables	4/-	15/9		27½	27½	6 19 3	17/9	15/9
Smith (England), S.	4/-	11/-		17½	17½	6 7 3	14/3	10/6
Southern Areas	£1	15/-		10	7½	10 0 0	28/9	16/3
Strand Elec.	5/-	6/9		17½	15*	11 2 3	8/6	6/9
Sturtevant	5/-	23/-		14·4†	15†	3 5 3†	31/3	22/6
Sun Elec.	£1	33/9		15	20	11 17 0	37/6	35/-
Switchgear & Cowans	5/-	14/-	+6d	20	25	8 18 6	17/-	13/6
Taylor Tunnicliff	5/-	11/3	−6d	15	15	6 13 3	14/-	11/3
T.C.C.	10/-	43/-		25	25	5 16 3	45/-	40/6
T.C. & M.	£1	27/6	+6d	8½	8½	6 3 9	34/-	26/-
Telephone Mfg.	5/-	7/6	+3d	10	10*	6 13 3	8/6	6/3
Thorn Elec.	5/-	16/3		20	15*	4 12 3	22/6	16/-
Thornycroft	£1	41/3		15	15*	7 5 6	49/9	41/3
Tube Investments	£1	60/-	+1/3	22½	14*‡	4 13 3	70/6	54/9
Vactric	5/-	12/6	+6d	15	17½*	7 0 0	15/-	11/6
Veritys	5/-	7/9	+3d	12½	12½	8 1 3	10/-	6/9
Walsall Conduits	4/-	13/3		70	20*	6 0 9	13/6	10/9
Ward & Goldstone	5/-	39/6	+9d	30	35	4 8 6	39/6	29/-
Watford	2/-	6/-		25	25	8 6 9	7/6	6/-
Westinghouse	£1	72/6		18	18	4 19 3	100/-	71/6
West, Allen	5/-	12/9		15	15	5 17 9	14/6	11/6
Wolf Electric	5/-	17/6		20	20	5 14 3	26/3	17/6
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A. Ord.	100	70½	−2	6	6	8 10 3	80	66
Ord.	100	45½		3¾	3¾	8 4 9	54	45
Anglo-Portuguese	£1	21/9		8	8	7 7 0	23/6	20/3
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	18/-	+1/-	22½	22½	6 5 0	20/-	15/6
Cable & Wireless:								
Ord.	5/-	10/-	−3d	10	10	5 0 0	11/3	9/6
4% Loan	100	91		4	4	4 8 0	92½	88
Calcutta Trams	£1	26/-	+6d	6†	7½†	5 15 6†	26/3	23/-
Cape Elec. Trams	£1	17/6		5½	7½	8 11 5	20/3	18/-
Marconi Marine	£1	31/6		10	10	6 7 0	34/-	31/-
Oriental Tel. Ord.	1/-	70/-		16	—	—	90/-	67/6
Telephone Rentals	5/-	10/6		12½	12½	5 19 0	11/9	9/9

Thorn Electrical Results

The 5s ordinary shares of Thorn Electrical Industries were raised to 18s in the market (the official quotation remained at 16s 3d) after the company's announcement of a 15 per cent dividend and of a further improvement in the trading profit, to £1·7 million, for the year ended last March. The dividend is at the rate to which it was increased a year ago, and applies to capital since enlarged by a one-for-two "rights" issue. It involves the distribution of about £137,000 net, or not much more than a quarter of the available surplus. The latter shows some reduction on the previous figure as a result of higher charges for taxation (which takes nearly £600,000) and depreciation. A yield of barely 4½ per cent on the shares reflects the "growth" characteristics which the market attributes to the shares, with reference, in particular, to the interests developing in association with the Sylvania company of America.

Preference Shares

While 3½ per cent War Loan is quoted on a yield basis of approximately 5 per cent, the lists of preference shares recently on offer in the market show that yields of approximately 6 per cent are to be had from such issues as British Thermostat 4½ per cent preference at 15s, the 5 per cent stocks of Pye and Reliance Clifton Cable, both available at about 16s 6d, and from E. K. Cole 5½ per cents at 18s 3d. Berry's Magicoal 6½ per cent preference are offered at par. English Electric 6½ per cents at 23s, and Tube Investments 4½ per cents at 15s 9d, give returns of a little under 5¾ per cent. On Vactric "sixes" at 13s 3d there is a yield of over 9 per cent.

"An Industry Within Industry"

The name of Johnson, Matthey & Co., Ltd., is associated with the refining of precious metals, but the company's activities go far beyond this, and it has now produced a well-illustrated brochure, "An Industry Within Industry," in which some of the many products and services of the company are described.

REPORTS and DIVIDENDS

The Dubilier Condenser Co., Ltd.—In his statement, which has been circulated with the report and accounts for the year ended 31st March last, Mr. F. H. McCrae (chairman and managing director) says that the quantity of components manufactured and sold constituted a record in the history of the company. This was made possible by completing the installation of new plant at the Acton factory in time to operate during part of the year. The profit, however, did not rise in proportion to the increased volume of production. This was due to their policy of refraining from increasing selling prices, even though they had to absorb substantial increases in wages, materials and general operating costs, and to meet competition it was necessary to reduce some selling prices, particularly in overseas markets.

By December, 1955, it became evident that the credit restrictions imposed by the Government were adversely affecting sales of radio and television sets; this resulted in the cancellation or suspension of orders by some of the customers. The effect of this recession in demand was partially offset by their having established new business in the electronic, nucleonic and atomic fields; in addition the business progressed in capacitors for industrial applications and devices for suppression of electrical interference with radio and television. Export sales increased, notwithstanding keen competition.

Berry's Electric Magicoal, Ltd.—The annual meeting was held on 15th August, Mr. Raymond Berry (chairman and managing director) presiding. In his circulated statement, the chairman said that sales reached a new record level although the measures of the Chancellor of the Exchequer to curb inflation were felt towards the end of the year. Sales of "Magicoal" fires and other heaters showed a marked increase. Export sales increased by 17 per cent. Extensions to the two factories at Birmingham and Wembley were nearing completion and provided for greatly improved production facilities. Sales of lighting fittings and switchgear remained steady, but the demand for water heaters declined severely as a result of hire purchase restrictions and the curtailment of promotional schemes by the Electricity Boards. They had recently introduced new designs in fires, lighting fittings and water heaters, which they were able to offer at prices relatively lower than they had ever previously achieved.

Christy Brothers & Co., Ltd., report a group profit for the year ended 31st March last of £30,193, as compared with £24,830 for the preceding year. Taxation absorbed £31,649. General reserve receives £17,235 and it is proposed to pay a dividend for the year of 7 per cent (unchanged). The balance carried forward is £36,945 (against £34,848 brought in).

Newton Brothers (Derby), Ltd.—The trading profit for the year ended 31st March last is £161,759, as compared with £271,355 for the preceding year. Income tax requires £77,972 and the net profit is £67,135 (against £122,558). Replacement of assets and equipment receives £9,240, research and development £20,000 and staff pensions £2,000. The dividend for the year is maintained at 12½ per cent and the bonus of 7½ per cent is also repeated. The balance carried forward is £46,052 (against £41,951 brought in).

Thorn Electrical Industries, Ltd., reports a consolidated trading profit for the year to 31st March last of £1,736,780, as compared with £1,501,610 for the preceding year, and after deducting depreciation and amortisation of £381,186, and taxation of £594,670, there is a net balance of £572,137 (against £609,007). General reserve receives £320,900 and it is proposed to pay a dividend for the year of 15 per cent (unchanged) on capital increased by a one-for-two rights issue. The balance carried forward is £243,947 (against £184,439 brought in).

British Relay Wireless & Television, Ltd.—The group trading profit for the year ended 30th April last is £710,118, as compared with £524,873 for 1954-55. After deducting depreciation and taxation, the net balance is £250,027 (against £161,528). It is proposed to pay a final dividend of 11 per cent on the "A" ordinary, making 16 per cent for the third successive year. The payment last year, however, was on £300,000 "A" ordinary capital, since when 800,000 "A" ordinary 5s shares have been issued to "A" and "B" ordinary shareholders. Holders of the "B" ordinary rank for dividends after not less than 16 per cent has been paid on the "A" ordinary for three consecutive financial periods. The balance carried forward is £160,482 (against £103,884 brought in).

Parmiter, Hope & Sugden, Ltd., have made arrangements to acquire the whole of the share capital of J. F. Collier & Co., Ltd., of Macclesfield, engineers and brass and iron founders.

The Rheostatic Co., Ltd., is paying an interim dividend of 5 per cent (against 6 per cent), on doubled capital.

Desoutter Bros. (Holdings), Ltd., are paying an unchanged interim dividend of 12½ per cent.

The Anglo-Portuguese Telephone Co., Ltd., proposes to repay temporary loans by the issue of debentures in Portugal (to be known as "obligations") to the value of 80 million escudos (approximately £1,000,000). The proceeds will be used to repay the temporary loans which, it is estimated, will have reached about £900,000 by 31st December next. The obligations will carry 5 per cent interest and rank *pari passu* with the existing debentures.

New Companies

T. H. Carr (Electrical), Ltd.—Registered 13th August. Capital £2,000. Electricians, electrical contractors, television and radio engineers, etc. Directors: T. H. Carr and Mrs. Margaret Carr. Regd. office: 36, Garnon Street, Mansfield, Notts.

John Geere (Bolton), Ltd.—Registered 3rd July. Capital £1,500. Electrical, automobile, mechanical, wireless, television, electronic and sound engineers, etc. Directors: J. Geere and Mrs. Elsie R. Geere. Regd. office: 503, Chorley Old Road, Bolton, Lancs.

Electro Apparatus (London), Ltd.—Registered 22nd June. Capital £100. Directors: C. J. Billett and Mrs. Betty O. Potter. Solicitors: Wood, Sons & Dale, E.

Boiler Plant Equipment, Ltd.—Registered 21st June. Capital £5,000. Electricians, mechanical engineers, etc. Solicitors: Duggan Elton & James, 43, Cannon Street, Birmingham.

Fergo Television Co., Ltd.—Registered 24th July. Capital £1,000. Directors: J. Firman and T. Goldberg. Regd. office: 84a, Kings Road, Prestwich, Lancs.

Gainsborough Electrical Co., Ltd.—Registered 3rd August. Capital £2,000. Electrical engineers and contractors, manufacturers of and dealers in dynamos, armatures, etc. Directors: L. Gainsborough (chairman) and T. W. Lovell. Solicitors: Crane & Hawkins, 2-3, Norfolk Street, W.C.2.

Middleton & Co. (Knutsford), Ltd.—Registered 5th July. Capital £100. Electrical contractors, etc. Directors: S. Platt and J. E. Waldron. Regd. office: 41, Princess Street, Knutsford.

Telectronic, Ltd.—Registered 5th July. Capital £150. Manufacturers of and dealers in electronic apparatus, machinery and instruments, etc. Directors: R. E. C. Randall, B. L. Talbot and R. D. Smith. Regd. office: 7, Elstree Hill, Bromley, Kent.

Berrypac, Ltd.—Registered 5th July. Capital £100. Electrical engineers, etc. Regd. office: 156, Strand, London, W.C.2.

Davisite, Ltd.—Registered 5th July. Capital £100. Particulars are similar to Berrypac, Ltd.

Dunstering Electrical Co., Ltd.—Registered 5th July. Capital £100. Particulars are similar to Berrypac, Ltd.

Liquidations

The Hill Service Co. (E. Hill), Ltd., suppliers of electrical equipment.—Winding up voluntarily. Liquidator, Mr. D. F. Gay, 39-41, New Broad Street, London, E.C.2, appointed 27th July.

Colley, Marriott & Co., Ltd., electrical engineers.—Winding up voluntarily. Liquidator, Mr. A. H. Colley, 88, Walton Street, London, S.W.3, appointed 8th August.

E. E. Morey, Ltd., radio and television engineers and electrical contractors.—Winding up. Liquidator, Mr. A. W. Hunter, Walter House, 418-422, Strand, London, W.C.2, appointed 1st August.

Bankruptcies

F. B. Williams, lately carrying on business at 123b, High Street, Blackwood, Mon., as an electrical retailer and contractor.—Trustee, Mr. T. H. Parker, County Court Buildings, Westgate Street, Cardiff, Official Receiver, released 2nd August.

R. H. Winslade, 7, Collingwood Mount, Portsmouth Road, Camberley, lately of 21, Park Road, Aldershot, electrical engineer.—Trustee, Mr. N. W. Osborne, 11-12, Finsbury Square, London, E.C.2, released 23rd July.

S. Sutton & Sons, 127, Sultan Road, Portsmouth, electrical dealers.—Receiving order made 9th August on a creditor's petition.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 29th August from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

10566. Henley's Telegraph Works Co., Ltd., W. T.—Bobbins for coil winders. 2nd May, 1952. (756021.)

20537. Postmaster General.—Television systems. 26th November, 1952. (755824.)

22425. National Research Development Corporation.—Electronic computing apparatus. 25th September, 1952. (755825.)

26482. Formby & Co., Ltd., J.—Electronic computing apparatus. 5th February, 1954. (756022.)

1952

720. Bazy, P. J. L., Brachet, C. M. F., and Leaute, P. M. A.—Electron discharge device with photo-conductive plate. 9th January, 1952. (756143.)

2506. British Thomson-Houston Co., Ltd.—Electromagnetic relay switching circuits. 18th December, 1952. (756024.)

11146. Standard Telephones & Cables, Ltd.—Calculators. 2nd January, 1953. (756144.)

18364. Mullard Radio Valve Co., Ltd.—Cold-cathode gas-discharge tube. 8th July, 1953. (755928.)

21286. Hotpoint Electric Appliance Co., Ltd.—Electrically heated hand irons. 25th August, 1953. (756029.)

21549. Mullard Radio Valve Co., Ltd.—Cold-cathode gas-discharge tubes. 30th July, 1953. (755929.)

24396. Electric & Musical Industries, Ltd.—Electrodes for electron-discharge devices. 24th September, 1953. (755830.)

31780. Soc. Française Radio-Eléctrique.—Cooling arrangements for the anodes of electronic tubes. 15th December, 1952. (755724.)

1953

1564. Egyesult Izzolampa Es Villamos-Sagi R. T.—Electric incandescent lamps. 19th January, 1953. (756033.)

2186. Clang, Ltd., and Harwood, C. D.—Slack absorbing devices for electric cables or cords. 22nd April, 1954. (756034.)

6201. General Descaling Co., Ltd.—Electrode for coating the interior of pipes. 5th March, 1954. (756037.)

7794. Sonotone Corporation.—Electric storage batteries. 20th March, 1953. (755938.)

8394. Standard Telephones & Cables, Ltd.—Coupling of a helix in a travelling-wave tube or the like to a waveguide. 26th March, 1953. (755834.)

10888. Barnaby Engineering Co. (1950), Ltd., and Smith, E. B.—Measuring apparatus, more particularly for electric cables and wires. 16th March, 1954. (756153.)

12515. Crompton Parkinson, Ltd.—Electric lamps. 31st March, 1954. (755838.)

15700. Silto Soc. Anon.—Electromagnetic eddy-current brakes. 8th June, 1953. (755943.)

16075. Telefunken Ges.—Circuit arrangements for the generation of sawtooth currents. 11th June, 1953. (756047.)

17037. Standard Telephones & Cables, Ltd.—R-F phase shifter. 19th June, 1953. (756048.)

17470. Parsons, Ltd., C. H., and Handley, G. B.—Lever operated electric switches. 24th June, 1954. (755730.)

19202. Licentia Patent-Verwaltungs-Ges.—Protective arrangement for mechanical current rectifiers. 10th July, 1953. (755732.)

19610. National Research Development Corporation.—Loaded waveguides. 6th August, 1954. (755843.)

21642. Associated Electrical Industries, Ltd.—Semi-conductors. 6th September, 1954. (755845.)

21852. Standard Telephones & Cables, Ltd.—Coded electric signal transmission system. 7th August, 1953. (756161.)

22812. Davis & Son Derby, Ltd., J., and Davis, W. B.—Electrical remote control switch apparatus. 18th August, 1954. (755733.)

24060. Combined Optical Industries, Ltd., and Marconi's Wireless Telegraph Co., Ltd.—Underwater television camera apparatus. 30th November, 1954. (756058.)

24537. Standard Telephones & Cables, Ltd.—Colour television receiver. 4th September, 1953. (755851.)

25085. Metropolitan-Vickers Electrical Co., Ltd.—Modulating circuits for electric oscillators. 9th September, 1954. (756060.)

26487. Philips Electrical Industries, Ltd.—Lighting apparatus embodying arc-discharge lamps. 25th September, 1953. (756167.)

26531. Avery, Ltd., W. & T. (Schenck Maschinenfabrik Ges., C.).—Process and device for the electrical registration of the unbalance of revolving articles. 26th September, 1953. (756168.)

29082. British Thomson-Houston Co., Ltd.—Operation of dynamo-electric machines in mutual synchronism. 20th October, 1954. (756063.)

30805. Metropolitan-Vickers Electrical Co., Ltd.—Thermal power plant. 15th October, 1954. (756065.)

31517. Mochi, E. G.—Electric capacitors. 13th November, 1953. (756066.)

32342. United Kingdom Atomic Energy Authority.—Method and apparatus for testing the presence of specific atomic elements in a substance. 22nd November, 1954. (755967.)

33408. Russell, W. M.—Electric kettles and the like. 23rd November, 1954. (755971.)

34389. Nettle Accessories, Ltd., and Revington, D.—Electric lampholders. 1st October, 1954. (756070.)

34529. Hardy, R. J.—Electronic spotting device applicable, in particular, for the guiding of rockets and other high speed appliances. 11th December, 1953. (756176.)

34672. Planer, G. V.—Electrical ceramics. 14th February, 1955. (Cognate application 9849, 3rd April, 1954.) (755860.)

35247. Automatic Telephone & Electric Co., Ltd.—Mounting arrangements for electrical components. 18th December, 1953. (755974.)

35550. Reyrolle & Co., Ltd., A.—High voltage electric circuit-breakers. 9th December, 1954. (756074.)

1954

45. Standard Telephones & Cables, Ltd.—Circuit arrangement for the generation of sawtooth shaped deflecting currents. 1st January, 1954. (Addition to 733495.) (755862.)

202. General Electric Co., Ltd., and Goodman, C. H. L.—Preparation of semi-conducting materials. 23rd December, 1954. (756178.)

282. General Electric Co., Ltd., and Simpson, A. I. F.—Apparatus for suppressing ripple on d.c. supplies. 31st December, 1954. (756180.)

1194. Bailey Meters & Controls, Ltd.—Constant potential sources. 13th January, 1955. (756182.)

1836. Cables & Plastics, Ltd.—Anchorage or connection devices for wires or cables. 10th November, 1954. (755864.)

2586. Sciaky, D.—Combination single-phase line frequency welder and impulse welder. 28th January, 1954. (755747.)

4126. Electrical Products (Colne), Ltd.—Plunger-operated electric switches. 10th February, 1955. (Cognate application 34893, 2nd December, 1954.) (755867.)

4613. Ferranti, Ltd.—Microwave phase-shifting devices. 14th February, 1955. (756192.)

4694. British Thomson-Houston Co., Ltd. (General Electric Co.).—Electric discharge devices. 17th February, 1954. (755985.)

5102. Whittaker, R.—Electrical dental pulp testing instruments. 5th January, 1955. (756081.)

6051. Allday & Son (1922), Ltd., H.—Electric socket contacts. 18th February, 1955. (755752.)

7115. Philips Electrical Industries, Ltd.—Transistor circuits. 11th March, 1954. (755870.)

7295. Philips Electrical Industries, Ltd.—Radio receivers. 12th March, 1954. (755756.)

7498. Lodge-Cottrell, Ltd.—Electrostatic precipitators. 16th December, 1954. (755757.)

8994. Minneapolis-Honeywell Regulator Co.—Magnetic modulator. 26th March, 1954. (756088.)

9944. General Electric Co.—Thermal insulating systems. 5th April, 1954. (756212.)

11130. Chamberlain & Hookham, Ltd., Deacon, L. O., and Lewis, H. S.—Protective means for use in electric power systems. 23rd March, 1955. (755768.)

13264. General Electric Co.—Colour television receivers. 6th May, 1954. (756216.)

14283. Telefonaktiebolaget L. M. Ericsson.—Electric circuits for starting and operating fluorescent discharge lamps. 14th May, 1954. (755776.)

17121. General Electric Co.—Gas turbines and fuel pumps operated thereby. 10th June, 1954. (755892.)

17383. Etablissements Merlin & Gerin Soc. Anon.—Contacts for electrical switchgear. 14th June, 1954. (755782.)

18122. Conitech, Ltd.—Convertible a.c. to d.c. power supply and battery charging means for portable electrical equipment. 21st June, 1954. (755785.)

19456. Philips Electrical Industries, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabriken).—Switching circuits comprising reverse parallel connected ignitrons. 2nd July, 1954. (756220.)

21088. Westinghouse Air Brake Co.—Electric current rectifier assemblies. 20th July, 1954. (755897.)

21569. Philips Electrical Industries, Ltd.—Annular permanent magnets secured to shafts. 23rd July, 1954. (755793.)

22338. McGraw Electric Co.—Magnetic core. 30th July, 1954. (755795.)

25528. Bach, C. G.—Branching clamp for electrical conductors. 2nd September, 1954. (756118.)

25626. Western Electric Co., Inc.—Electric switches, especially electromagnetic relays. 3rd September, 1954. (756119.)

25832. Bendix Aviation Corporation.—Electrical phase detector. 6th September, 1954. (756120.)

26273. Standard Telephones & Cables, Ltd.—Electromagnetic relay. 10th September, 1954. (755906.)

26744. Westinghouse Electric International Co.—Reactors employing nuclear fissionable material. 15th September, 1954. (756014.)

26895. General Electric Co.—Antidiffusion diaphragms for radiography. 16th September, 1954. (755802.)

27523. Philips Electrical Industries, Ltd.—Device for producing frequency modulated ultra-short waves. 23rd September, 1954. (756123.)

27818. Philips Electrical Industries, Ltd.—Methods of producing getters. 27th September, 1954. (755804.)

34062. Western Electric Co., Inc.—Attenuation equalisers for electrical wave transmission systems. 24th November, 1954. (755916.)

34373 and 34545. General Electric Co.—Gain control circuits for semi-conductor amplifiers. 26th November, 1954. (756016/7.)

36421. Proctor Electric Co.—Temperature responsive control device. 16th December, 1954. (755812.)

37546. Rauland Corporation.—Electron discharge devices. 29th December, 1954. (755819.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—6th September. Southern Electric Authority of Queensland. Two 3,000 kVA transformers. (E.S.B. 20759/56. Ten/20823.)*

10th September. Electricity Commission of New South Wales. Six 15 MVA, 66/33/11 kV transformers. (E.S.B. 20037/56. Ten/20705.)*

Burma.—6th September. Union Purchase Board. 7,750 electric lamps. (E.S.B. 20458/56. Ten/20767.)*

Eastleigh.—3rd September. Borough Council. Street lighting equipment. (See this issue.)

Formosa.—4th September. Central Trust of China, Purchasing Department. Electrical machinery and apparatus including motors, magnetic and disconnecting switches, cables, transformers, telephone wire, lightning arrestors, bulbs, etc. (E.S.B. 20068/56.I.C.A. Ten/20695.)* 5th September. Electrical apparatus including electricians' hand tools, switches, meters and measuring instruments, small transformers, chokes, microphones, speakers, resistors, capacitors, motors, generators, electronic equipment, etc. (E.S.B. 20095/56.I.C.A. Ten/20789.)*

India.—30th August. Director General of Supplies and Disposals. Six electrically-operated coal drills. (E.S.B. 20808/56. Ten/20813.)* 5th September. L.v. paper insulated cables. (E.S.B. 20214/56. Ten/20722.)* 23rd October. Three water tube steam boilers and two 5,000 kW turbo-alternator sets. (E.S.B. 20204/56. Ten/20716.)*

10th September. Government of Mysore. A.c.s.r. conductors and accessories. (E.S.B. 20584/56. Ten/20783.)*

14th September. India Supply Mission, Washington. Photographic and cinematographic apparatus including 54 1·5 kVA transformers. (E.S.B. 20562/56.I.C.A. Ten/20779.)*

6th September. Government of Madras. 764 50/100/250 kVA transformers. (E.S.B. 20694/56. Ten/20807.)* 28th September. 58,550 electricity meters. (E.S.B. 20367/56. Ten/20772.)*

Italy.—10th October. Ministero della Difesa-Aeronautica, Rome. Complete electric network at an airfield. (E.S.B. 21164/56. Ten/20887.)*

Llwchwr.—12th September. U.D.C. Street lighting equipment. (See this issue.)

Newmarket. — 8th September. U.D.C. Street lighting equipment. Surveyor, Council Offices, Severals House, Bury Road.

Northern Ireland.—3rd September. Electrical installation in St. Mary's Training College, Falls Road, Belfast. Scottish Boiler & General Insurance Co., Ltd., 10, College Square South, Belfast.

5th September. Alterations and additions to the electrical installation in St. Patrick's High School, Saul Street, Downpatrick, Co. Down. Varming & Mulcahy, consulting engineers, 37, Malone Road, Belfast.

14th September. Electrical installation in the new boys' and girls' primary school, Magheralin, Co. Down. Houston & Beaumont, architects, 9, Market Street, Lurgan.

Norway.—1st September. Oslo Municipal Electricity Works. Two 38,000 kVA or two 37,000 kVA a.c. generators for the hydro-electric power plant Hemsil I in Hemsedal Valley. (E.S.B. 20364/56. Ten/20762.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Otley.—29th September. U.D.C. Two electrically-driven sewage pumps. Silcock & Simpson, consulting engineers, 10, Park Row, Leeds, 1.

Portuguese East Africa.—26th September. Ports, Railways and Transport Department, Lourenço Marques. Street lighting equipment. (E.S.B. 18932/56. Ten/20733.)*

Skegness.—31st August. U.D.C. Electrical installations in 28 houses on the Sundial estate. Surveyor, Town Hall.

South Africa.—Union Tender and Supplies Board. 6th September. Electrically-operated workshop machines. 30th August. Cinema studio lamps, and dairy equipment. (E.S.B. 20198/56 and 20201/2/56. Ten/20701/2/3.)*

5th September. Stores Department, South African Railways. Six 53-cell, 110 V, 10 Ah batteries. (E.S.B. 20801/56. Ten/20800.)* 7th September. Copper wire, switchboards and storage cells. 5th September. Overhead track equipment. (E.S.B. 20191/2/3/4/5/56. Ten/20687/8/9/90/91.)*

14th September. Durban Corporation, Electricity Department. 115 isolator panels and 30 oil circuit-breakers. (E.S.B. 20640/56. Ten/20797.)* Telephone cable. (E.S.B. 20639/56. Ten/20798.)* Telephone wire. (E.S.B. 20638/56. Ten/20801.)*

Turkey.—5th September. Office of the Purchasing and Contracting Officer, Allied Land Forces South Eastern Europe, Izmir. Fluorescent lamps. (E.S.B. 20353/56. Ten/20752.)*

ORDERS PLACED

Cardiff.—Corporation Estates Committee. Recommended. Installation of two electric passenger lifts at the Wood Street omnibus offices (£5,052).—Evans (Lifts), Ltd.

Middlesbrough. — Corporation Education Committee. Accepted. Electrical installation work at the Southend School (£1,140).—E. Dixon Barker & Sons, Ltd.

Mildenhall.—R.D.C. Accepted. Electrical installations in 42 Cornish unit houses at Rattlers Road, Brandon (£1,090).—Eastern Electricity Board.

Newcastle-on-Tyne. — Regional Hospital Board. Accepted. Electrical work at new admission block and convalescent villas at St. George's Hospital, Morpeth (£28,903).—Watson-Norie & Co., Ltd. Electrical installation at new employment block and three male villas at Prudhoe and Monkton Hospital (£7,152).—Veale-Nixon & Co., Ltd. Electrical installation at Dryburn Hospital, Durham (£1,125).—Fairbairn & Partners, Ltd.

Peterborough.—Corporation Housing Committee. Accepted. Electrical installations in 84 houses and 16 flats (£1,554).—M. F. Hansen.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Altrincham.—Shops (16) and flats (29), Broomwood estate; borough surveyor.

Atherstone.—Extensions and alterations to Council Offices; D. C. Smith, R.D.C. surveyor, Council Offices, Atherstone, Warwicks.

Barking.—Dwellings (278), Thames View estate; borough architect.

Additional factory buildings; Thames Plywood Manufacturers, Ltd., Harts Lane.

Blackburn.—County mixed secondary modern school at Shadsworth; borough engineer, Town Hall.

Bristol.—St. Bernadette Secondary Modern School, Knowle; Kenneth Nealon & Partner, architects, 28, Orchard Street.

Chelmsford.—Flats (33), New Writtle Street; Johnson Crozier, Ltd., builders, New Street.

Coventry.—Office block for J. Musson & Co., Ltd., Cross Road; Barnard Rayner, architect, 5, Manor Road.

New premises at the Corporation Street/Fretton Street corner site; Coventry Newspapers, Ltd., Quinton Road.

Durham.—Modern school at Middleton-St. George (£130,000); Cairns and Byles, electrical consultants, 8, Osborne Road, Newcastle-on-Tyne.

Family group homes (25) (£101,659) and county offices (£1,500,000); G. R. Clayton, county architect, South Street.

Hampshire.—Junior schools at Bishopstoke, Cowplain and Crofton; county architect, The Castle, Winchester.

Hastings.—Large block of flats and restaurant on site of Eversfield House Hotel (after demolition); proprietor, Eversfield Place, St. Leonards.

Hebburn.—County junior and infant school; county architect, Durham.

Heywood.—Office block, Adelaide Street; James Berry, Ltd., Chapel Street.

Kettering.—Departmental store at Market Place; Morgan Squire (Furnishers), Ltd., drapers and furnishers, Hotel Street, Leicester.

Leeds.—Central baths on site near Eastgate; second section of scheme for alterations to Central Restaurant, Town Hall; city architect, Priestley House, Quarry Hill, 9.

London.—Dwellings (168), Hanbury Road, Acton; borough engineer.

Office block, Aldwych corner, Strand; Adams, Holden & Pearson, architects, 38, Gordon Square, W.C.1.

Factory building and offices, 5/7, Tedford Way, Acton; Adrema, Ltd., 2-10, Tedford Way, W.3.

Margate.—Houses and flats (125) on the Addiscombe Road site; W. L. Armstrong, borough surveyor, 38, Grosvenor Place.

Newcastle-on-Tyne.—First phase of new West Cumberland Hospital, for Special Area Committee for Cumberland and North Westmorland; regional architect, Walker Gate Hospital, Benfield Road.

Northumberland.—Modern school at Haltwhistle (£150,000); remodelling of Duke's Grammar School, Alnwick (£25,000); R.C. modern school at Longbenton (£148,000); junior schools at Gosforth; and conversion of Shortridge Hall, Warkworth, into old people's home (£25,000); county architect, County Hall, Newcastle-on-Tyne.

Plymouth.—Hotel at Bishop's Place, etc., site, for H. G. Simonds, Ltd., brewers, Reading; Evans and Sloggett, architects, Grimstone Terrace, Houndiscombe Road.

Reading.—South Secondary School for Girls; Howard V. Lobb & Partners, architects, 20, Gower Street, W.C.1.

Stourport. — Two-storey extensions to secondary modern school, Burlish Road; Nicol, Nicol & Thomas, architects, 111, New Street, Birmingham, 2.

Sutton Coldfield.—Factory in Forge Lane; Heaton Ward, Ltd., steel fabricators, 94, Bath Street, Birmingham, 4.

Wakefield.—Works extensions; W. Sugden & Sons, Ltd., Vicarage Street.

Worthing.—Bungalows (103), Palatine Road, Goring; Cinderwood Property Co., Ltd., 21, Richmond Place, Brighton.

Writtle.—Hostel buildings at the Essex Institute of Agriculture (£85,000); H. Conolly, Essex county architect, County Hall, Chelmsford.